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EXPERIMENTAL EVALUATION OF TRANSONIC STATORS

DATA AND PERFORMANCE REPORT
MULTIPLE-CIRCULAR-ARC STATOR A (SLOTTED)

PREPARED FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONTRACT NAS3-7614

Pratt & Whitney Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION

EAST HARTFORD CONNECTICUT

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EXPERIMENTAL EVALUATION OF TRANSONIC STATORS

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by

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prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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EAST HARTFORD, CONNECTICUT

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FOREWORD

This report was produced in accordance with NASA contract NAS3-7614 for NASA Lewis Research Center, Cleveland, Ohio. It describes test results and calculations on the performance of the Multiple-Circular-Arc Stator A (Slotted).

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I. SUMMARY

A slotted stator was tested over a range of flow angles and velocities. The stator was designed having multiple-circular-arc airfoils with minimum curvature over the forward portion, consistent with flow-choking limitations. The transition point between the forward and rearward sections was located at the assumed point of shock impingement. The stator was slotted from the tip to 40 percent of span and from 60 percent of span to the hub. The slots were designed to eject high-energy flow at the assumed shock impingement point. Stator inlet flow was generated by means of an inlet guide vane and a flow-generating rotor. Transonic stator inlet flow was achieved at design speed, but Mach numbers were slightly lower than the design values. Measured minimum stator losses at mid-span were lower than the NASA loss correlation for comparable Mach numbers. Near the blade ends, the losses increased sharply. At mid-span, the stator exhibited a minimum total pressure loss coefficient, $\bar{\omega}$, of 0.075 at design speed. The inlet Mach number and diffusion factor at minimum loss were 0.93 and 0.53 respectively. Near the hub at 90 percent of span, the stator minimum total pressure loss coefficient, inlet Mach number, and diffusion factor were 0.166, 0.98, and 0.65 respectively. At 10 percent of span, the stator minimum total pressure loss coefficient, inlet Mach Number, and diffusion factor were 0.088, 0.86, and 0.50 respectively. At 5 and 95 percent of span, the stator minimum total pressure loss coefficients were 0.21 and 0.24 respectively. At design speed, minimum loss occurred at zero degrees incidence to the suction surface at 5, 10, 30, and 50 percent of span. At 70, 80, 90, and 95 percent of span, minimum loss occurred at positive incidences. Stator deviations at the midspan were 3 to 4 degrees greater than predicted. Deviations at 10 and 90 percent of span from the tip are 5 and 9 degrees greater than predicted.

Analysis indicates that the flow through the stator slot was at or near choke conditions at design speed and at all higher speeds. At design speed, total slot flow at wide open throttle was 2.94 percent of the compressor weight flow. At part throttle, slot flow was 3.20 percent of the compressor weight flow. Near stall, slot flow was 3.64 percent of the compressor weight flow. At all speeds, the ratio of slot flow to compressor weight flow increased with increasing back pressure.

Maximum airflow at design speed was 134.3 lb/sec which is 0.7 lb/sec less than design value. Overall stage efficiency at design speed and 134.3 lb/sec airflow was three points lower than predicted.

II. INTRODUCTION

Under Contract NAS3-7614 to NASA, the Pratt & Whitney Aircraft Division of United Aircraft Corporation investigated blade element performance of stators designed to operate in the transonic range.

The objective of this investigation was to obtain blade element data on a family of multiple-circular-arc (MCA) blade shapes, which are considered suitable for stator blade sections that operate at high-flow Mach numbers. This new family of blade shapes is defined as two double-circular-arc blade segments joined at a common transition point, where the forward and rearward portions of the blade are circular-arc sections of different radii. These blades shapes are aimed at controlling the flow turning over the forward portion of the blade with respect to the total turning to minimize losses associated with flow shocks.

The contract included testing three different stator airfoil shapes utilizing an inlet guide vane and flow generation rotor. Two stators have multiple-circular-arc airfoils with the supersonic turning equal to 0.6 of that for an equivalent double-circular-arc airfoil stator. One multiple-circular-arc design (MCA Stator A) has the transition point between the low curvature forward section and the rearward section at the assumed passage shock position. The other design (MCA Stator B) has its transition point moved to the rear of the shock location. A third stator with double-circular-arc (DCA) airfoils provides a basis for comparison.

The three sets of stators were designed for an inlet relative Mach number of 1.1 at the hub and an inlet flow angle of 48 degrees. The blading was designed to turn the flow to the axial direction at all radii. A hub solidity of 1.91 was selected along with an aspect ratio of 2.06, which resulted in 63 blades having a chord of 2.155 inches. Detail design of these stators, along with the design of the inlet guide vane and flow generation rotor, is given in Reference 1. The measured performance of these stators is presented in References 2, 3, and 4.

When employing the MCA blade shape in an attempt to reduce shock losses in transonic compressor blading, the flow turning in the forward portion of the blade row is reduced. Thus, to achieve the overall flow turning desired, the turning, and therefore, the loading must be increased in the rear portion of the blade. If the loading is high in this region the flow will tend toward separation. One technique which may help to counteract the tendency toward separation is flow slots from pressure to suction surface. By bleeding high energy air from the pressure to the suction surface the boundary layer along the suction surface can be energized, minimizing the effect of shock boundary layer interaction and the increased loading over the rear portion of the blade. Because of the potential of flow slots as a means of reducing diffusion losses in transonic blading, the program was modified to include testing of two slotted stator designs. The two stators selected for slotting were the MCA Stators A and B.

This report presents blade element performance of the slotted MCA Stator A. Also presented are overall performance data for the combination of inlet guide vane and rotor and for the combined overall performance of the inlet guide vane, rotor and MCA Stator A (Slotted). Data were to have been obtained over a range of flows from maximum flow to stall from 50 percent through 120 percent of design speed. The rotor failed during operation at 120 percent of speed after recording one data point. The remainder of the testing of the slotted MCA Stator A and the scheduled tests of the slotted MCA Stator B were cancelled.

III. SYMBOLS

The following symbols are used:

A	- area, ft^2
A_{an}	- annulus area, ft^2 (3.76 at the inlet guide vane leading edge)
A_f	- frontal area, ft^2 (5.241 at the inlet guide vane leading edge)
c	- chord length, in
D	- diffusion factor
i_m	- incidence angle, angle between inlet air direction and line tangent to blade mean camber line at leading edge, degrees
i_s	- incidence angle, angle between inlet air direction and line tangent to blade suction surface at leading edge, degrees
M	- Mach number
N	- rotor speed, rpm
P	- total pressure, psfa
p	- static pressure, psfa
r	- radius, ft
S	- blade spacing, in
T	- total temperature, °R
t	- static temperature, °R
t/c	- thickness-to-chord ratio
U	- rotor speed, ft/sec
V	- air velocity, ft/sec
W	- weight flow, lbs/sec
X	-distance along chord line, inches

SYMBOLS (Cont'd)

β - air angle, angle between air velocity and axial direction, degrees

γ - ratio of specific heats

$\Delta\beta$ - air turning angle, degrees

δ - ratio of inlet total pressure to standard pressure of 2116.22 lbs/ft^2

$\delta°$ - deviation angle, angle between exit air direction and tangent to blade mean camber line at trailing edge, degrees

η - efficiency, %

θ - ratio of inlet total temperature to standard temperature of 518.6°R

ρ - mass density, $lbs\text{-}sec^2/ft^4$

σ - solidity, ratio of chord to spacing

$\overline{\omega}$ - total pressure loss coefficient

ω - angular velocity of rotor, radians/sec

Superscripts:

$'$ - relative to moving blades

$*$ - designates blade geometry

Subscripts:

ad - adiabatic

p - polytropic

r - radial direction

z - axial direction

θ - tangential direction

0 - plenum chamber

SYMBOLS (Cont'd)

1	- instrument plane upstream of inlet guide vane (IGV)
2	- station at IGV leading edge
3	- station at IGV trailing edge
4	- instrument plane upstream of rotor
5	- station at rotor inlet
6	- station at rotor exit
7	- instrument plane upstream of stator
8	- station at stator leading edge
9	- station at stator trailing edge
10	- instrument plane downstream of stator

IV. APPARATUS AND PROCEDURE

A. Compressor Test Facility

The compressor test facility is shown schematically in Figure 1. It is equipped with a gas-turbine-drive engine using a 2.1:1 gearbox to give the optimum speed-range capability.

Air enters through a calibrated nozzle for flow measurements. A 72-foot straight section of 42-inch-diameter pipe runs from the nozzle to a 90-inch-diameter inlet plenum. Wire-mesh screen and an "egg-crate" structure located midway through the plenum provide a uniform pressure profile into the compressor.

The compressor airflow is exhausted into a toroidal collector and then into a 6-foot-diameter discharge stack. A 6-foot-diameter valve in the stack provides back pressure for the test compressor. Two smaller valves, one 24-inch and one one 12-inch, in bypass lines provide vernier control of back pressure.

B. Test Compressor

The test compressor, as shown in Figure 2, is a single stage, axial-flow compressor with an inlet guide vane. It has a constant outside diameter of 31.0 inches and a hub/tip ratio at the stator inlet of 0.70. The inlet guide vane has 27 NACA M400 series vanes, the rotor 28 double-circular-arc blades, and the stator 63 vanes. Complete details of the design are given in Reference 1.

1. Inlet Guide Vane and Rotor

The inlet guide vane and rotor were designed to produce the desired stator inlet flow angle and Mach number distribution. Blade element performances for the inlet guide vane and rotor are given in Reference 2.

2. Stator

The multiple-circular-arc stator is composed of sections of two double-circular-arc blades, joined at a common transition point as shown in Figure 3. The two independent double-circular-arc sections allow control of the amount of supersonic turning and permit optimizing shock losses with respect to diffusion losses in order to obtain minimum overall losses. The transition point for the MCA Stator A airfoil was located at the assumed shock location, as was the maximum thickness point. Supersonic suction-surface camber was set at 0.6 that of a double-circular-arc stator having the same inlet and outlet conditions. A summary of the stator design values for eight streamlines at which blade element data were obtained is given in Table I.

TABLE I

STATOR DESIGN DATA, MCA STATOR A (SLOTTED)
(Station 8 - Station 9)

Percent of Stator Leading Edge Span from O.D.

	5	10	30	50	70	80	90	95
Inlet Dia.	30.54	30.02	28.18	26.35	24.52	23.60	22.69	22.30
Exit Dia.	30.60	30.05	28.38	26.74	25.11	24.32	23.53	24.24
β_8	41.63	41.46	41.57	42.55	44.02	45.04	46.89	48.08
β_9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M_8	0.85	0.86	0.90	0.94	1.00	1.04	1.06	1.07
σ	1.412	1.437	1.525	1.627	1.740	1.803	1.870	1.896
t/c	0.078	0.076	0.068	0.060	0.052	0.048	0.044	0.042
c	2.155	2.155	2.155	2.155	2.155	2.155	2.155	2.155
i_m	11.2	11.1	10.3	9.3	7.9	7.1	6.2	5.8
$\delta°$	9.5	9.2	8.6	8.5	8.7	9.0	9.7	9.8
$\overline{\omega}$	0.071	0.073	0.080	0.091	0.108	0.117	0.130	0.136
D	0.52	0.52	0.53	0.54	0.55	0.56	0.57	0.58

Stator leading and trailing edge radii are both 0.01 inch across the span. Design incidence to the suction surface is 0°.

After the MCA Stator A was tested without flow slots, it was slotted in two spanwise-sections, from the tip to 40 percent of span, and from 60 percent span to the hub. Airflow entered the slot on the pressure surface and was injected into the flow stream along the suction surface at the assumed shock impingement location. The typical blade spacing and slot location relationship is shown in Figure 4. Slot geometry nomenclature including Coanda radius, wedge angle, nominal throat and discharge angle is shown in Figure 5. A summary of the slot design geometry for 10, 30, 70 and 90 percent of span is given in Table II. Photographs of the MCA Stator A (Slotted) are presented in Figure 6.

TABLE II

SLOT DESIGN DATA, MCA STATOR A

	Percent of Stator Leading Edge Span From O.D.			
	10	30	70	90
Inlet Dia., inches	30.02	28.18	24.52	22.69
Wedge Angle, degrees	10	10	10	10
Slot Throat, inches	0.038	0.038	0.036	0.036
Discharge Angle, degrees	20	19	23	21
Coanda Radius, inches	0.122	0.122	0.082	0.082
X/c at Slot Inlet	0.169	0.155	0.195	0.204
X/c at Slot Exit	0.339	0.320	0.308	0.316

C. Instrumentation

Instrumentation was identical with that used for testing of the DCA Stator, which is described in Reference 4, except for:

- the addition of four static pressure taps located at the throat of the stator slot at 30 and 70 percent of span. These static pressure taps were used to determine the slot flow as a percent of the corrected weight flow.
- no blade surface static pressures forward of 35 percent of chord. The leads for these static pressure taps were interrupted by the airfoil slot.

The general construction features of the temperature rake, pressure rakes and traverse probes are illustrated in Figure 7. Figure 8 shows the station number designation and location of instrumentation and the leading and trailing edge planes. Figure 9 shows the circumferential location of instrumentation.

D. Test Procedure

The test procedure was the same as for the DCA Stator tests, which is described in Reference 4.

Overall performance and blade element performance tests for the MCA Stator A (Slotted) were run at 50, 70, 90, 100, 110, and 120 percent of design speed. Five complete data points and one near stall point were obtained at all speeds except 120 percent. At 120 percent design speed, only one data point was obtained. A rotor blade failure precluded further testing. Complete data points included the radial traverse measurements of total pressure, static pressure, and air angle, before and after the stator, together with hub wall, blade surface, and slot throat static pressure measurements and wake rake traverses of stator exit total pressure and temperature. Near-stall points were run without traversing ahead of the stator.

E. Calculation Procedure

Data were reduced using the procedure described in Reference 4 to calculate axisymmetric flow conditions in the compressor. Stator vector diagram data and performance parameters were calculated at 5, 10, 30, 50, 70, 80, 90, and 95 percent of blade height.

Performance parameters are defined as follows:

a. Incidence Angle (based on mean camber line)

$$i_m = \beta_8 - \beta_{8m}^* \qquad \text{(Stator)}$$

b. Deviation

$$\delta^o = \beta_9 - \beta_9^* \qquad \text{(Stator)}$$

c. Diffusion Factor

$$D = 1 - \frac{V_9}{V_8} + \frac{r_8 V_{\theta 8} - r_9 V_{\theta 9}}{(r_8 + r_9)\,\sigma\, V_8} \qquad \text{(Stator)}$$

d. Loss Coefficient

$$\bar{\omega} = \frac{P_8 - P_9}{P_8 - p_8} \qquad \text{(Stator)}$$

e. Loss Parameter

$$\frac{\bar{\omega} \cos \beta_9}{2\sigma} \qquad \text{(Stator)}$$

f. Polytropic Efficiency

$$\eta_p = \frac{\frac{\gamma-1}{\gamma}\ln\left(\frac{p_9}{p_8}\right)}{\ln\left(\frac{t_9}{t_8}\right)} \qquad \text{(Stator)}$$

g. Adiabatic Efficiency

1. $$\eta_{ad} = \frac{\left(\frac{P_6}{P_0}\right)^{\frac{\gamma-1}{\gamma}} - 1}{\left(\frac{T_{10}}{T_0}\right) - 1} \qquad \text{(IGV - Rotor)}$$

2. $$\eta_{ad} = \frac{\left(\frac{P_{10}}{P_0}\right)^{\frac{\gamma-1}{\gamma}} - 1}{\left(\frac{T_{10}}{T_0}\right) - 1} \qquad \text{(IGV - Rotor - Stator)}$$

h. Pressure Coefficients

1. $$C_p = \frac{p_{(local)} - p_8}{1/2\ \rho_8\ V_8^2} \qquad \text{(Stator)}$$

2. $$\text{S factor} = \frac{P_8 - p_{(local)}}{1/2\ \rho_8\ V_8^2} \qquad \text{(Stator)}$$

Note: Leading edge values of local static pressure for C_p and S factor were set equal to the inlet stagnation pressure; trailing edge values for C_p and S factor were based on calculated static pressure at the stator exit plane.

The slot flow was calculated for the inner and outer slot by the following method. The total pressure at the slot throat was assumed equal to the measured total pressure at the stator inlet. With the assumed total pressure and a measured

static pressure at the slot throat at 30 and 70 percent of span, respectively, the Mach number was determined. The average Mach number along the radial extent of each slot was assumed to be equal to that at the location where the static pressure was measured. With the Mach number, A*/A was calculated for each slot using the following formula.

$$\frac{A^*}{A} = \frac{M}{\left[\dfrac{2\left(1+\frac{\gamma-1}{2}M^2\right)}{\gamma+1}\right]^{\frac{\gamma+1}{2(\gamma-1)}}}$$

Knowing the flow area for each of the slots, and with the slot throat total temperature and total pressure assumed to be equal to the measured values at the stator inlet for the 30 and 70 percent streamline, the weight flow rates were calculated using the following formula.

$$W_{slot} = \rho VA = \frac{p}{Rt} VA = \frac{p\,VA}{\sqrt{\gamma Rt}} \sqrt{\frac{\gamma}{R}} \sqrt{\frac{T}{t}} \frac{1}{\sqrt{T}}$$

which is equivalent to

$$W_{slot} = \left[\left(\sqrt{\frac{\gamma}{R}}\right) \frac{M}{\left(1+\frac{\gamma-1}{2}M^2\right)^{\frac{\gamma+1}{2(\gamma-1)}}}\right] \frac{A_{slot}\ P}{\sqrt{T}}$$

Setting the Mach number equal to unity, we find

$$W_{slot} = \left[\sqrt{\frac{\gamma}{R}\left(\frac{2}{(\gamma+1}\right)^{\frac{\gamma+1}{\gamma-1}}}\right] \frac{A_{slot}\ P}{\sqrt{T}}$$

Using the values $\gamma = 1.4$ and R = 53.3 ft lbf/lbm^{o}R, corresponding to air, and correcting flow per unit area for Mach numbers other than unity by multiplying by A*/A we obtain a convenient form used in calculating the flow through each slot.

$$W_{slot} = \frac{0.532\ A_{slot}\ P}{\sqrt{T}} \left(\frac{A^*}{A}\right)$$

The total slot flow was then the summation of the inner and outer slot flow rates. This flow rate was then ratioed to the total weight flow through the stage to obtain the percentage of slot flow to total flow.

F. Rotor Blade Failure

While at 120% of design speed a rotor blade failure caused a termination of further testing. Two rotor blades broke off near their base, causing severe damage to the inlet guide vanes, other blades in the rotor, and the stator blade row. Visual and metallurgical examination of the two failed rotor blades showed that they failed in fatigue, with the fatigue origin approximately 1 inch above the root platform near mid-chord on the blade concave side. Examination of the remaining blades showed no evidence of fatigue failures. A stress analysis conducted after the failure, using improved methods not available at the time the rotor was designed, showed both peak static stress and peak vibratory stress for the first torsional mode occurring near the failure origin. This combination is considered the most probable cause of the fatigue failure, but the source of excitation for first mode torsional vibration at 120 percent speed was not determined. The analysis was supported by experimental data obtained on a spare rotor blade. This rotor blade was strain-gaged and vibrated mechanically to determine the first three natural frequencies, mode shapes, and stress distributions.

A stress survey conducted at the initiation of obtaining data at 120% of design speed did not reveal a resonance at or near this speed, but because of the narrow speed range over which the resonance could occur, it could have been overlooked during strain gage monitoring. The fact that only two blades showed fatigue failure is further evidence that this resonance condition must have occurred over a narrow frequency band. The remaining blades, due to their small differences in natural frequencies must not have been tuned to the exciting force which resulted in the failure of the other two blades. Figure 10 shows the rotor assembly after failure. Figure 11 shows the two failed rotor blades after removal from the rotor assembly. Figures 12 and 13 show the area of fatigue progression on the two failed rotor blades. The arrows in Figures 11, 12, and 13 indicate the point of fatigue origin. The brackets in Figures 12 and 13 show fatigue progression.

V. RESULTS AND DISCUSSION

Overall performance of the inlet guide vane, rotor, and stator and the blade element performance of the slotted MCA Stator A are presented. Overall performance is presented in plots of pressure ratio and efficiency versus weight flow, with corrected speed as a parameter. Stator blade element performance, including loss coefficient, diffusion factor, and deviation, are presented as functions of incidence. Curves have been drawn through data generated at common test speeds, with design values shown for comparison. Tabulations of Mach number ranges for each speed line were added for convenience. Static pressure distributions for the stator surface and hub channel versus chord length are plotted. Velocity vectors and blade element performance parameters for the slotted MCA Stator A are tabulated in Appendix A. Pressure distribution data are tabulated in Appendix B.

Inlet guide vane and rotor performance and the performance of the MCA Stator A before slotting are presented in Reference 2.

A. Overall Performance

Figure 14 presents overall performance of the inlet guide vane, rotor and stator in terms of pressure ratio and efficiency versus corrected weight flow, $W\sqrt{\theta}/\delta$, and versus corrected specific weight flow, $W\sqrt{\theta}/\delta A_{an}$, for five corrected rotor speeds. Stall lines were extrapolated from the characteristic speed lines to the measured stall airflows. Figure 15 presents the overall performance of the inlet guide vane and rotor combination for the five corrected speeds. The data point which was obtained at 120 percent of design speed was found to be in error and was deleted from the results.

Figure 14 shows that the maximum flow obtained at design speed was 134.3 pounds per second, or 0.7 pound per second less than design flow. The stage efficiency and pressure ratio at this flow and design equivalent speed were 76.8 percent and 1.451 compared with the predicted values of 79.7 percent and 1.485. Maximum stage efficiency obtained at design speed was 79.6 percent at a pressure ratio of 1.533 and an airflow of 128.6 pounds per second. Maximum pressure ratio obtained at design speed was 1.569 at an airflow of 120.5 pounds per second and stage efficiency of 78.0 percent. The low value of stage efficiency can be partially attributed to the fact that the stator loading is very high compared to the rotor work input and that the high stator losses result in a high ratio of loss to work input and therefore a low efficiency.

Performance of the rotor combined with the inlet guide vane is presented in Figure 15. At design-equivalent speed and 134.3 lb/sec, efficiency is 88.5 and pressure ratio is 1.53 compared with predicted values of 89.3 percent and 1.550.

B. Blade Element Performance

Blade element performance of the slotted MCA Stator A for five speeds is presented in Figures 16, 17, and 18. Figures show diffusion factor, deviation and total pressure loss coefficient versus incidence, with one plot for each spanwise location. Data were calculated at axial stations corresponding to the leading and trailing edges of the stator.

In general the loss plots exhibit the following trends:

- An increase in minimum loss with increasing Mach number.
- A narrowing of low loss incidence range as Mach number increases.
- Increased minimum loss incidence with increases in Mach number.

Measured mid-span minimum losses at design speed were lower than predicted for comparable values of Mach number. Near the blade ends losses were higher than predicted. Test minimum loss coefficients at mid-span were lower than the predicted loss coefficients at all speeds. At design speed, measured mid-span values of minimum loss coefficient, inlet Mach number and diffusion factor are 0.075, 0.93 and 0.53, respectively. Design mid-span values of loss coefficient, inlet Mach number and diffusion factor are 0.091, 0.94 and 0.54, respectively. Near the hub at 90 percent of span, the stator minimum total pressure loss coefficient, inlet Mach number and diffusion factor were 0.166, 0.98 and 0.65, respectively. At 10 percent of span, the stator minimum total pressure loss coefficient, inlet Mach number and diffusion factor were 0.088, 0.86 and 0.50, respectively. At 5 and 95 percent of span, the stator minimum total pressure loss coefficients were 0.21 and 0.24, respectively. Minimum loss values taken from the curves of Figure 18 are compared with design values in Figure 19.

At design speed, minimum loss occurred at zero degrees to the suction surface at 5, 10, 30 and 50 percent of span. At 70, 80, 90 and 95 percent of span, minimum loss occurred at positive incidences.

Stator loadings for design speed and design incidences are somewhat lower than predicted at 10 and 50 percent of span and higher than predicted at the hub. The measured D factors at zero degrees of incidence at 10, 50 and 90 percent of span are 0.49, 0.52 and 0.63, respectively, compared to predicted loadings of 0.52, 0.54 and 0.57.

Deviations at the mid-span are 3 to 4 degrees greater than predicted. Deviations at 10 and 90 percent from the stator tip are 5 and 9 degrees greater than predicted. The effect of incidence and loading on deviation appears to vary with inlet Mach number.

The stator loss parameter, $\frac{\bar{\omega} \cos \beta_9}{2\sigma}$, is presented versus diffusion factor for each of eight radial locations in Figure 20. Curves have been drawn through the minimum values at each speed. Minimum loss parameters versus D factor are shown in Figure 21 for all eight radial locations.

Flow through the stator slot was at or near choke conditions above 90 percent of design speed. At design speed, total slot flow at wide-open throttle was 2.94 percent of the compressor weight flow for a slot extending 80 percent of the blade span. At part throttle, total slot flow was 3.20 percent of the compressor weight flow. Near stall, total slot flow was 3.64 percent of the compressor weight flow. At all speeds tested, slot flow as a percentage of compressor weight flow increased with increasing back pressure. Total slot flow as a percentage of compressor weight flow is shown in Figure 22 for five corrected speeds. Figure 23 shows the slot flow choke parameter, A^*/A, versus corrected weight flow for five corrected speeds. An A^*/A ratio of 1.0 represents choked flow.

Chordwise distributions of the ratio of local static pressure on the hub to stator inlet pressure at 90 percent of span are shown in Figure 24. This figure represents wide-open throttle, part throttle and near stall for 50, 100 and 110 percent of operating speed. Static pressures were measured along the hub, midway between two stator vanes. Rapid increases in pressure at the open throttle operating points at design speed and 110 percent of design speed indicate the presence of flow shocks in the channel.

Chordwise distributions of pressure coefficient (C_p) on the stator surfaces are shown in Figures 25 through 30. Pressure coefficients (S Factor) are shown in Figures 31 through 36. The data are presented for wide open throttle, part throttle, and near stall at 50, 100 and 110 percent design speed. The pressure distribution which corresponds to near minimum loss is indicated in the figure subtitles. Data for all speeds and throttle settings are tabulated in Appendix B. For blade rows having flow slots, the pressure coefficient data are more difficult to interpret than the pressure coefficient data taken on unslotted blade rows. For unslotted blade rows, a rapid increase in static pressure along the blade surface very likely indicates the presence of a passage shock. The presence of these passage shocks is more apparent at higher speeds where the flow Mach number is higher. The pressure coefficient data presented in references

2, 3, and 4 indicate the presence of passage shocks at the higher flow Mach numbers. For slotted blade rows, sharp gradients in static pressure along the blade suction surface can result from local flow acceleration around the slot Coanda radii followed by a rapid deceleration downstream of the slot, (Reference 6) as well as from the presence of passage shocks. The injection of the slot flow into the flow stream along the suction surface can also affect the suction surface pressure gradients upstream of the slot. As mentioned in the Instrumentation Section, pressure coefficient data for the MCA stator A (slotted) were not obtained forward of the slot location. Because of the effect that slot flow can have on the pressure distribution over the blade surfaces and because no pressure distributions were obtained forward of the slot, it is difficult to determine if the sharp gradients noted in the pressure coefficients indicate the presence of a passage shock or if they are the result of the slot flow. Comparing the pressure coefficent data of the unslotted stator (Reference 2) with that of the MCA stator A (slotted), at 50 percent design speed a sharp increase in static pressure is apparent along the blade suction surface of the slotted blade and is not indicated in the data obtained on the unslotted stator. At this low speed (and thus low Mach number), it is unlikely that any passage shocks are present for either the slotted or unslotted blade, and that the sharp pressure gradients noted in the slotted stator are due to the slot flow. At the higher speeds, sharp gradients in static pressure are indicated for both the unslotted and slotted stator configuration. For the slotted stator it is likely that where a passage shock is present its location is forward of the slot, with the slot flow resulting in the passage shock taking the form of an oblique shock near the suction surface. As noted in the design of the slots covered under the Test Compressor Section, the slot exit was located so that air was injected into the flow stream along the blade suction surface at an assumed shock impingement location.

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5. Robbins, William H., Jackson, Robert J., and Lieblein, Seymour, "Blade Element Flow in Annular Cascades, Aerodynamic Design of Axial-Flow Compressors," NASA SP-36, 1965, ch. VII, pp. 227-254.

6. Linder, Charles G., Jones, Burton A., "Single Stage Experimental Evaluation of Slotted Rotor and Stator Blading, Part II - Annular Cascade Investigation of Slot Location and Geometry," NASA CR-54545, PWA FR-1669.

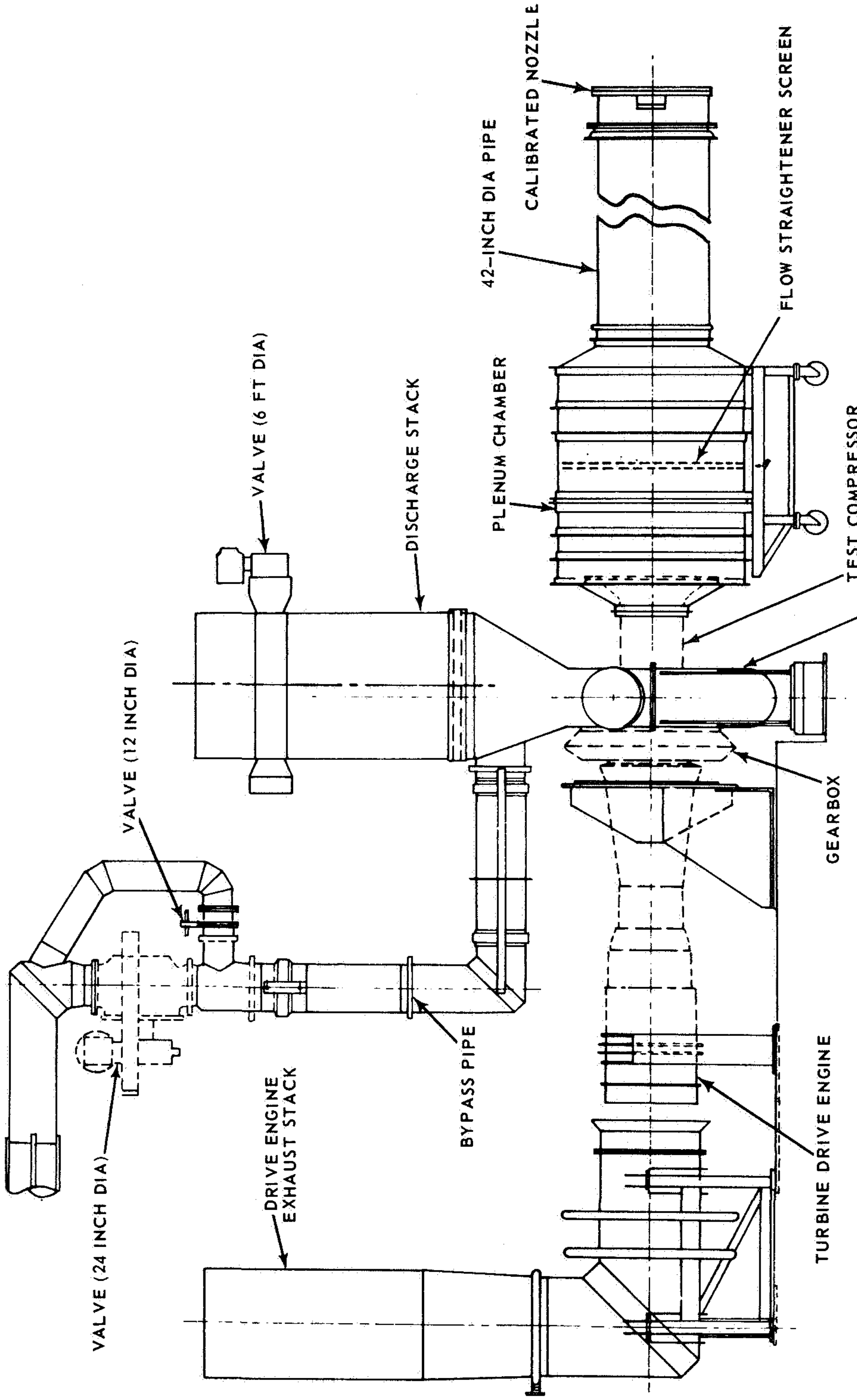


Figure 1 Schematic of Compressor Test Facility

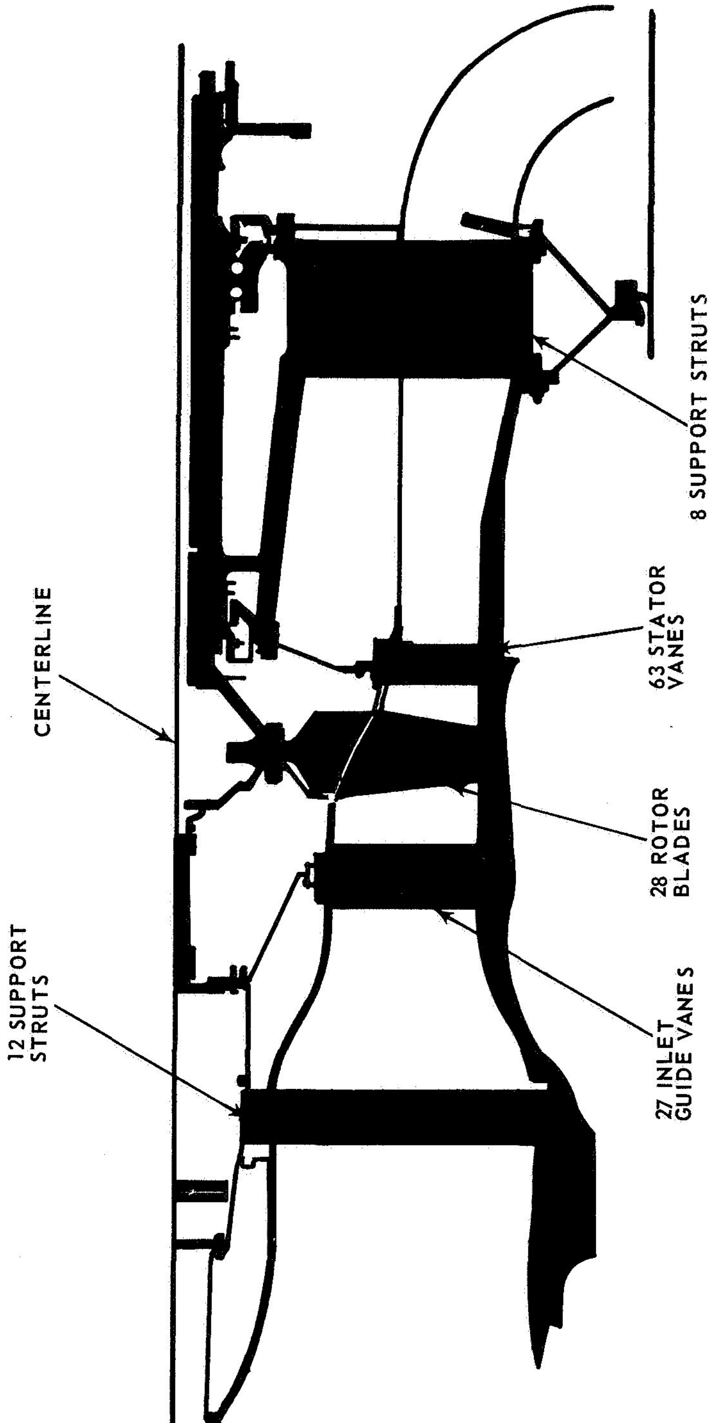


Figure 2 Cross Section of Test Compressor

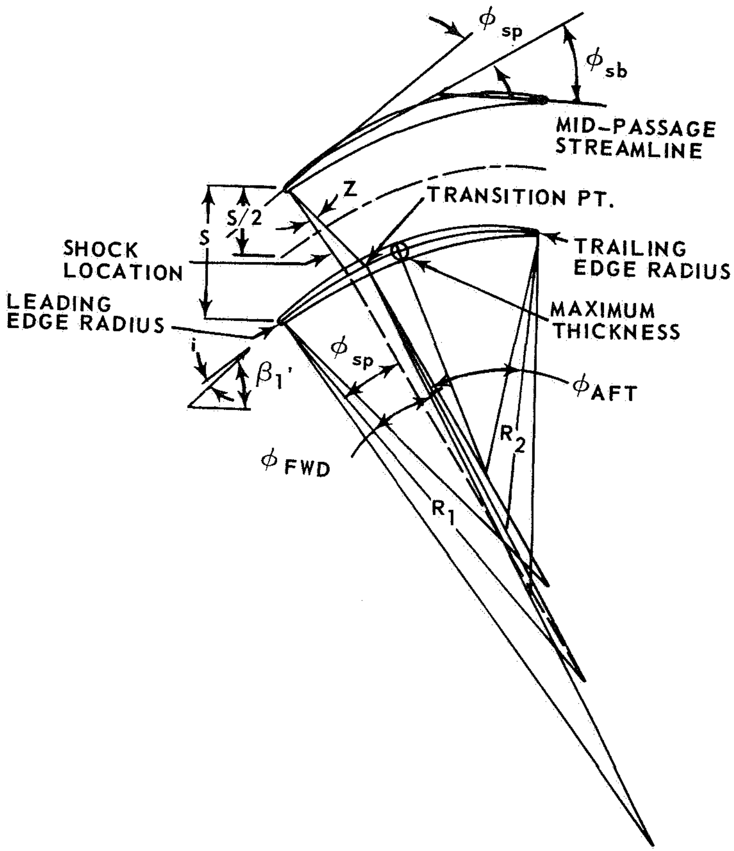


Figure 3 Multiple-Circular-Arc Blade Geometry

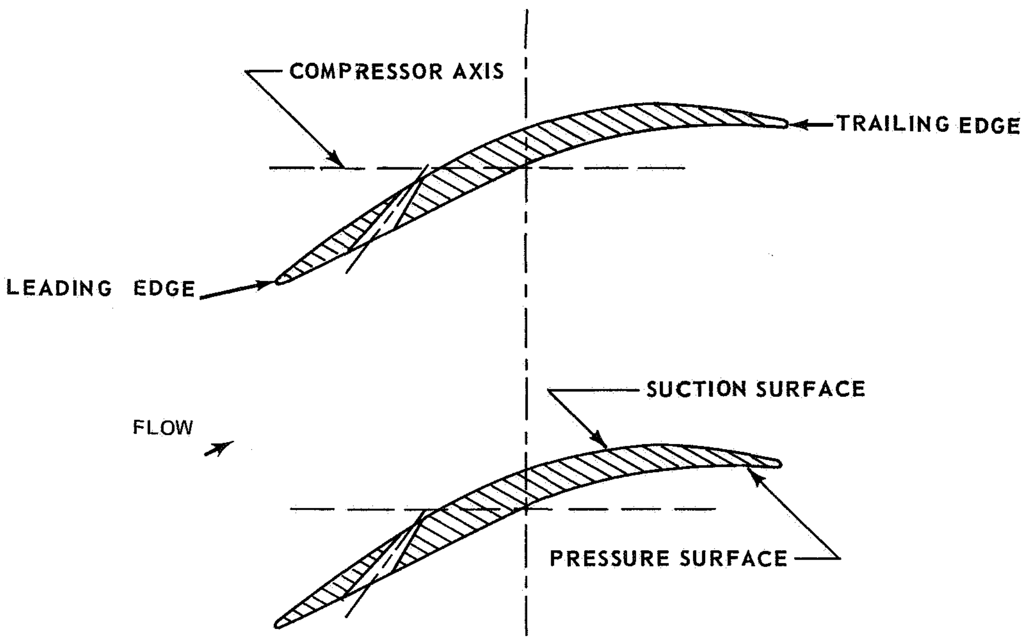


Figure 4 Cross-Sectional View of Multiple-Circular-Arc Stator A (Slotted), Showing Typical Blade Spacing and Slot Location

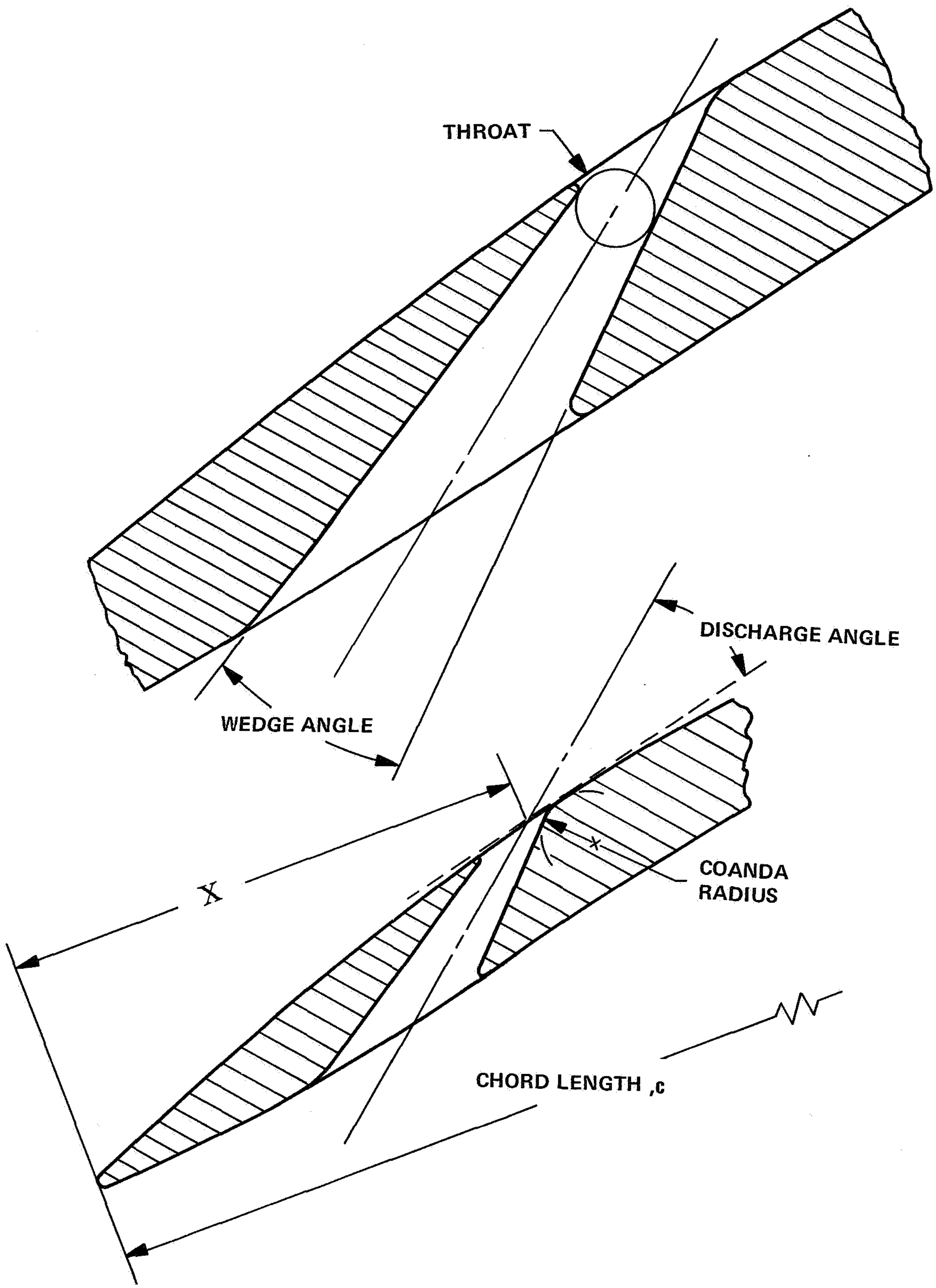


Figure 5 Partial Cross-Section of MCA Stator A (Slotted), Showing Slot Geometry Nomenclature

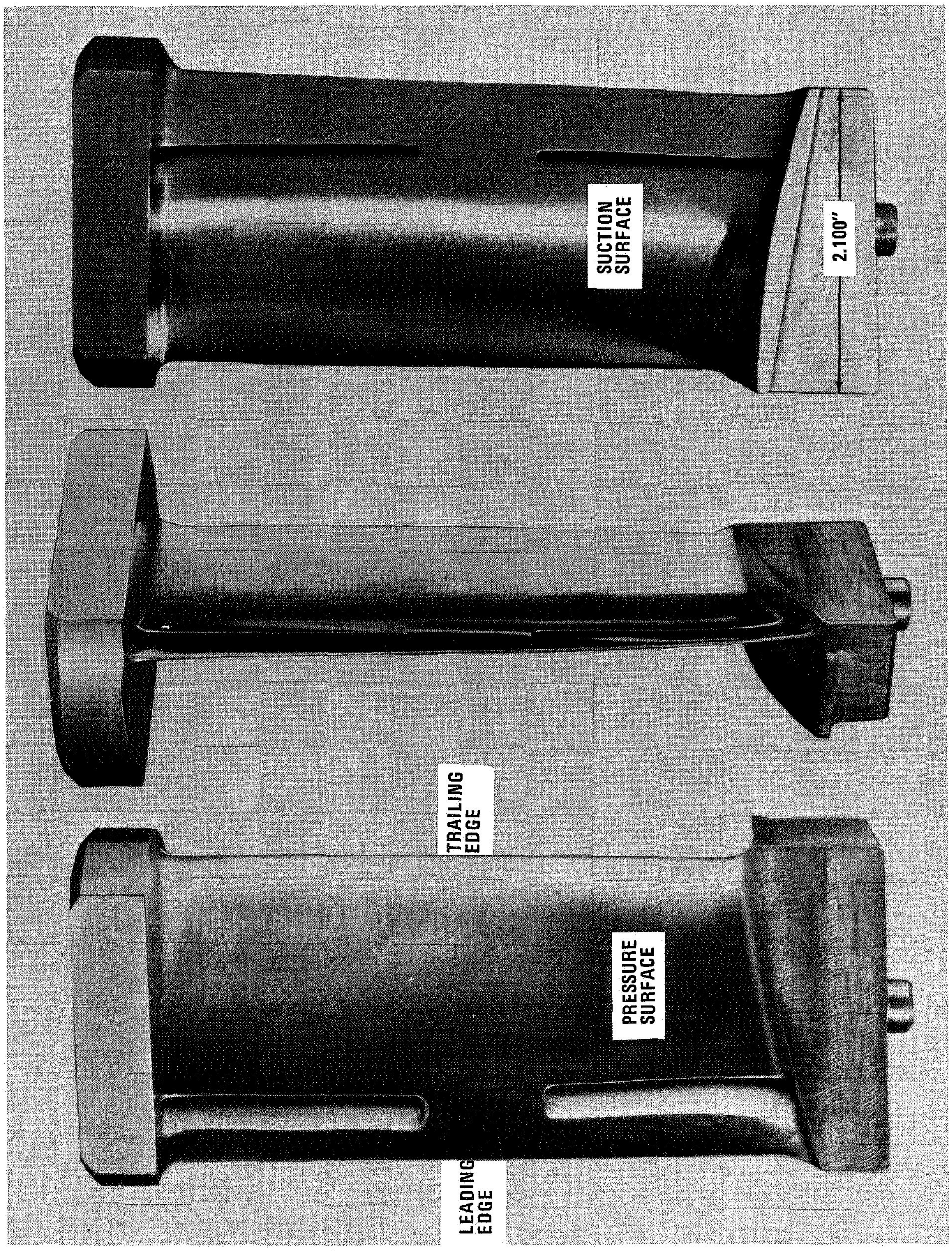
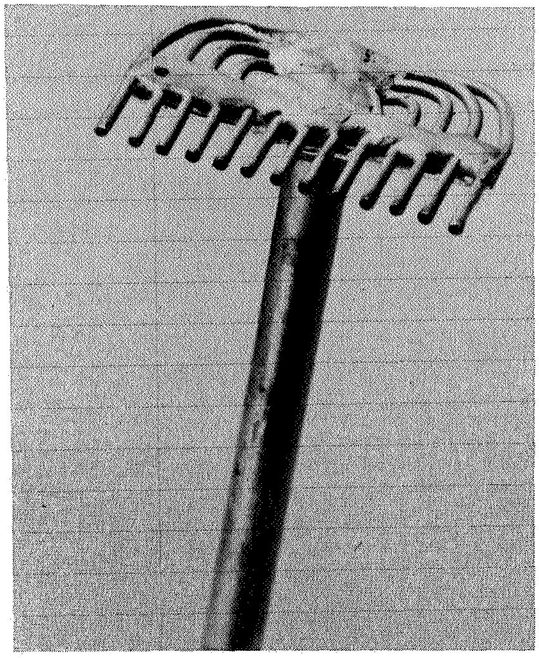
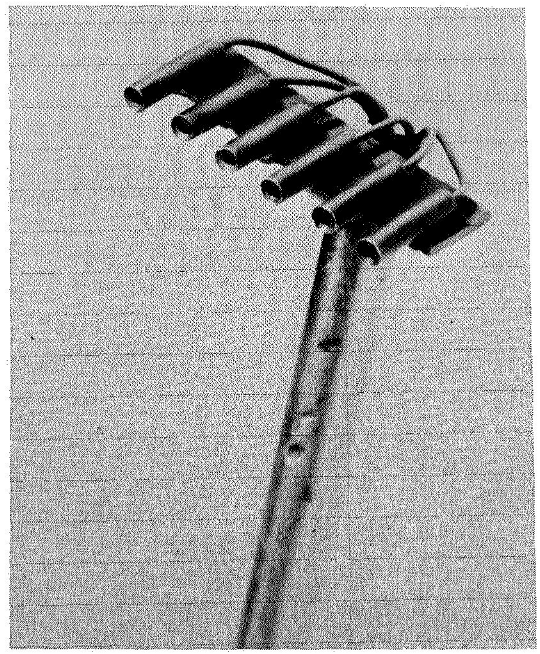


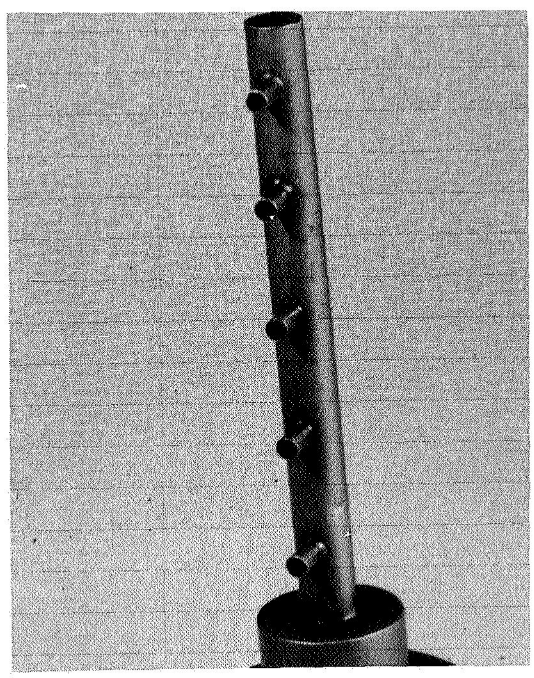
Figure 6 Multiple-Circular-Arc Stator A (Slotted)



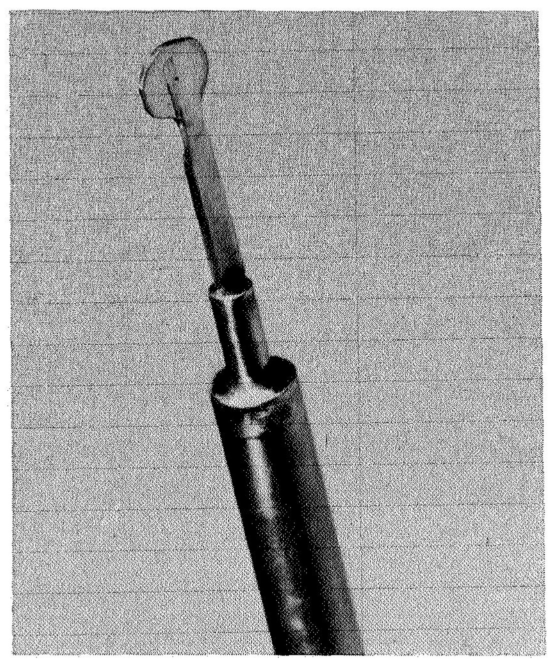
Pressure Wake Rake



Circumferential Temperature Rake



Radial Temperature Rake



Disk Probe

Figure 7 Compressor Instrumentation

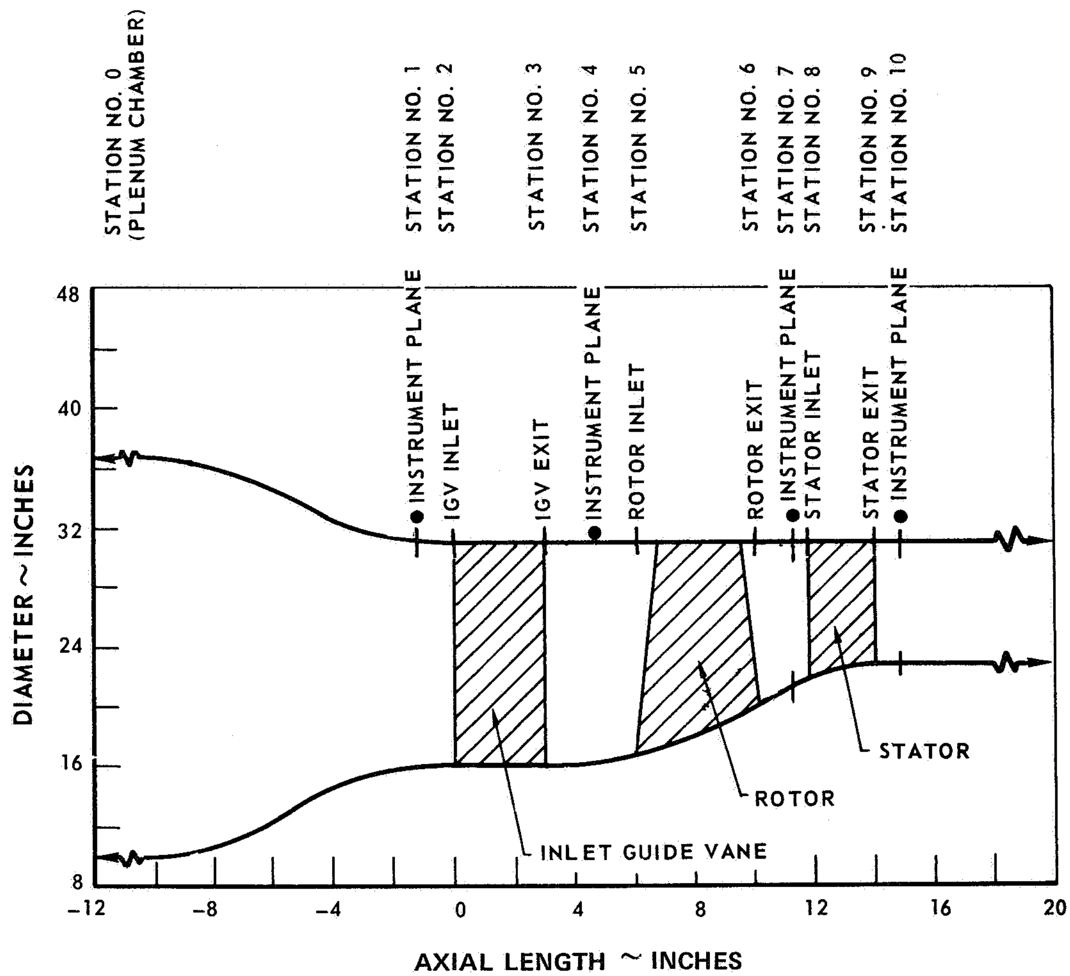


Figure 8 Station Number Designation and Location of Instrumentation and Blade Leading and Trailing Edge Planes

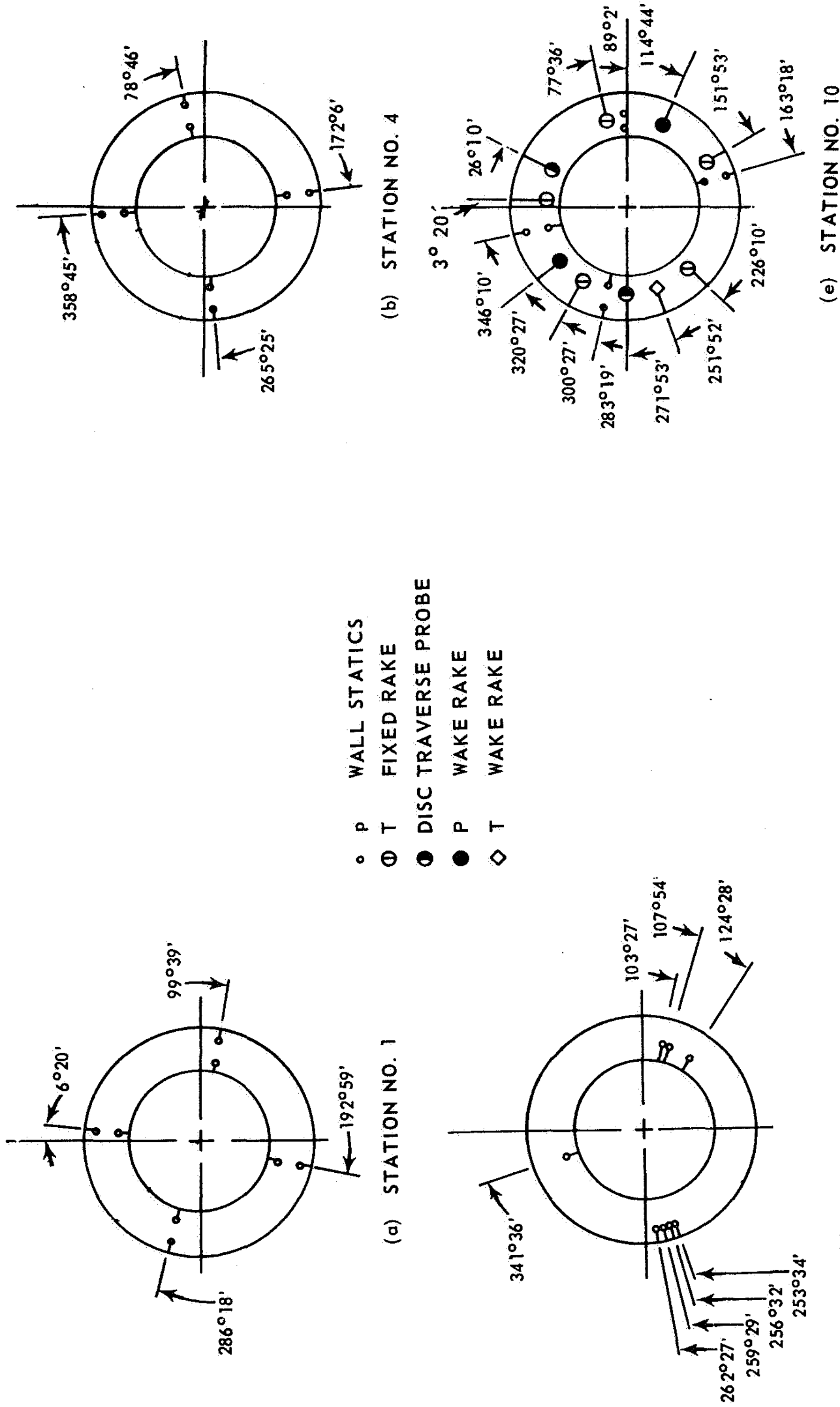


Figure 9 Circumferential Position of Instrumentation

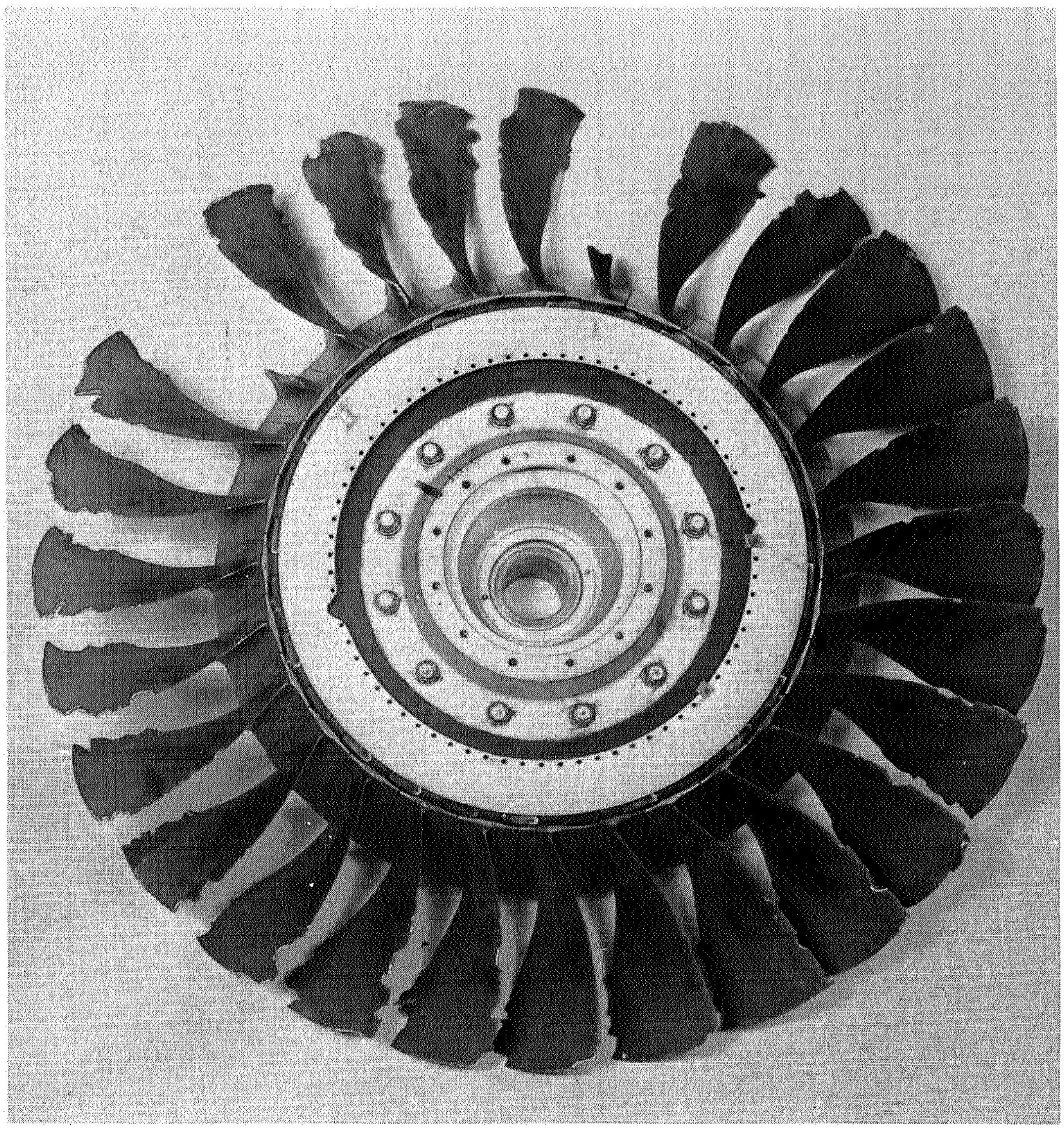


Figure 10 Compressor Rotor Assembly After Failure

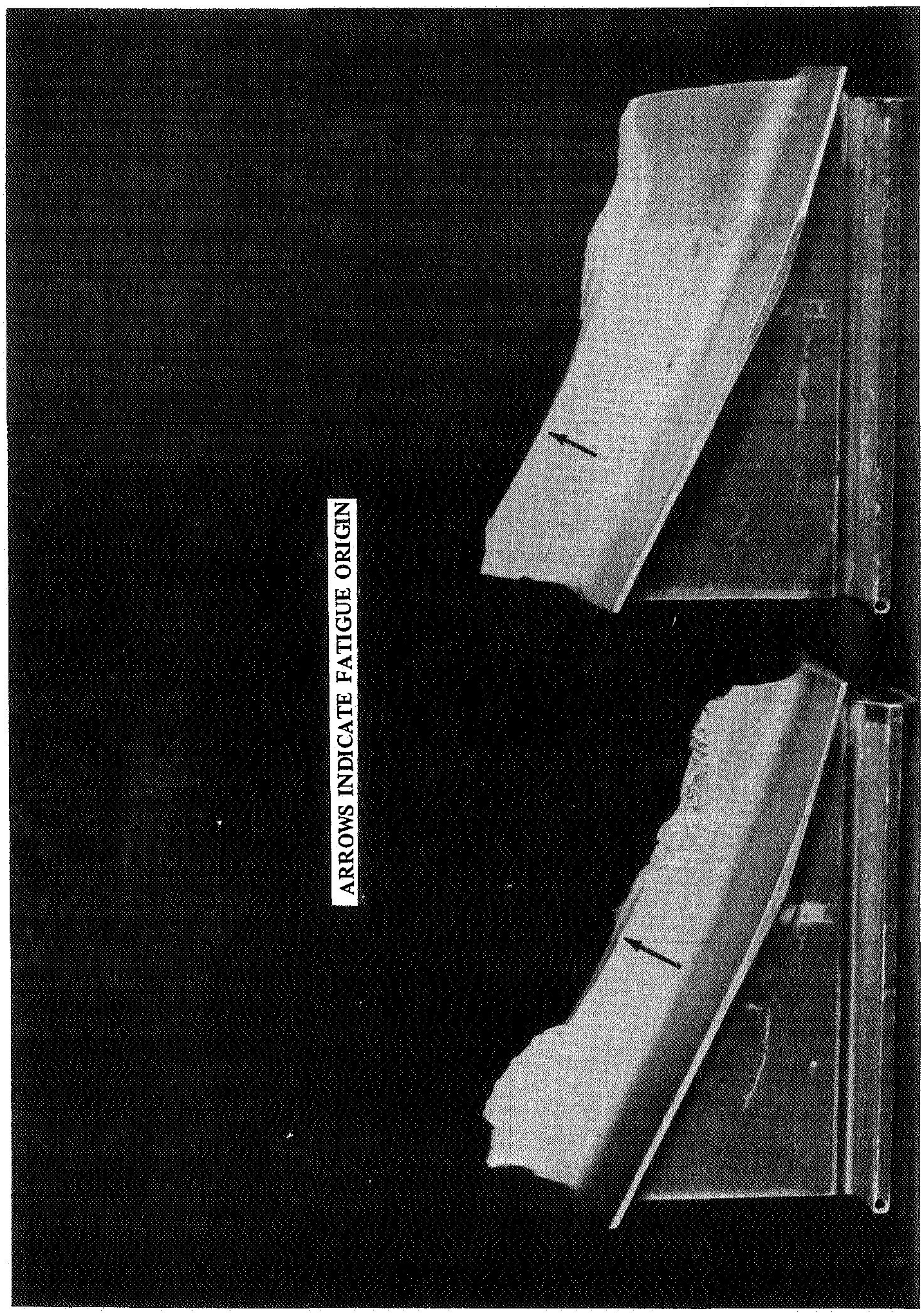


Figure 11 Failed Rotor Blades

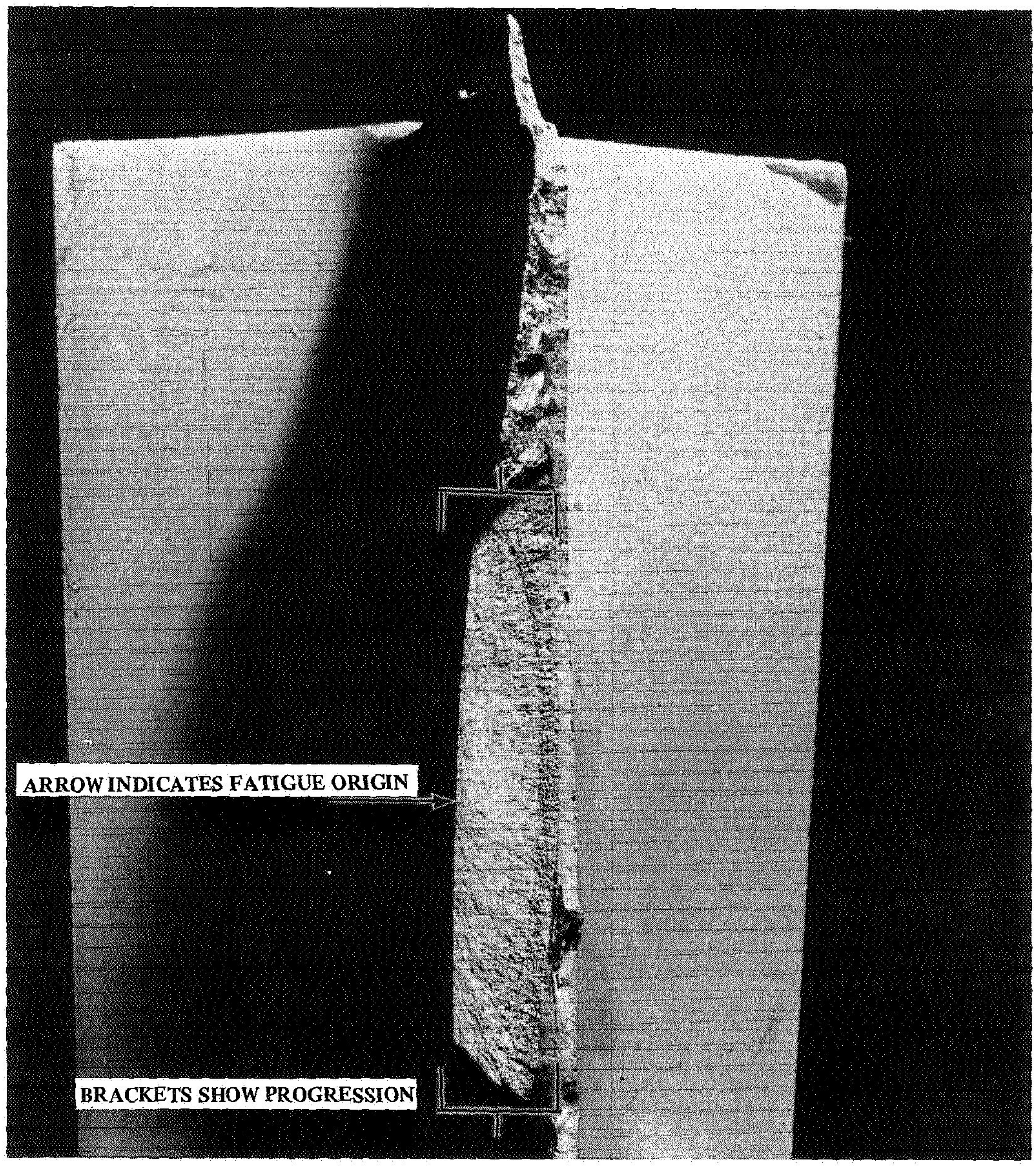


Figure 12 Fatigue Progression on Failed Rotor Blade No. 1

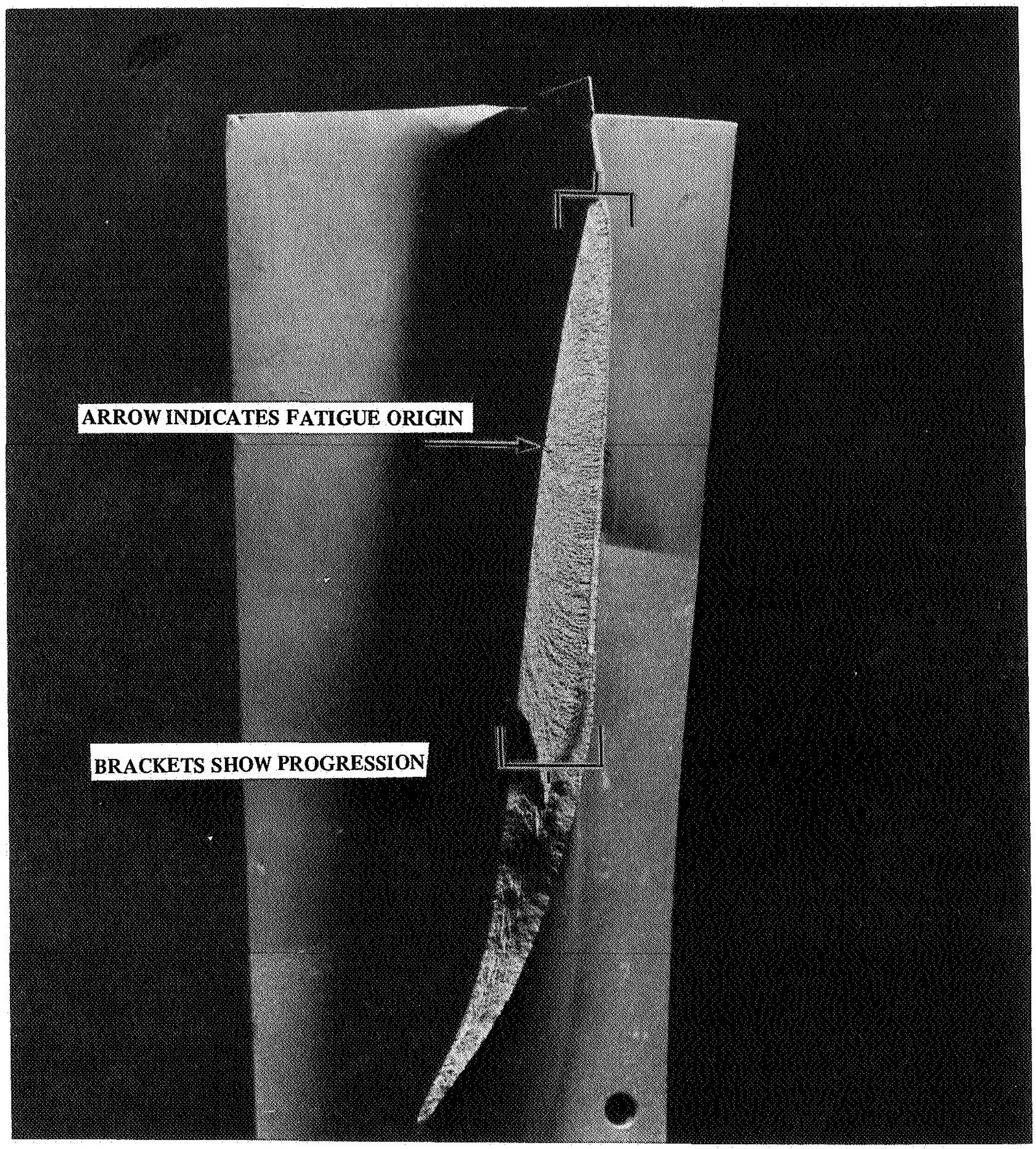


Figure 13 Fatigue Progression on Failed Rotor Blade No. 2

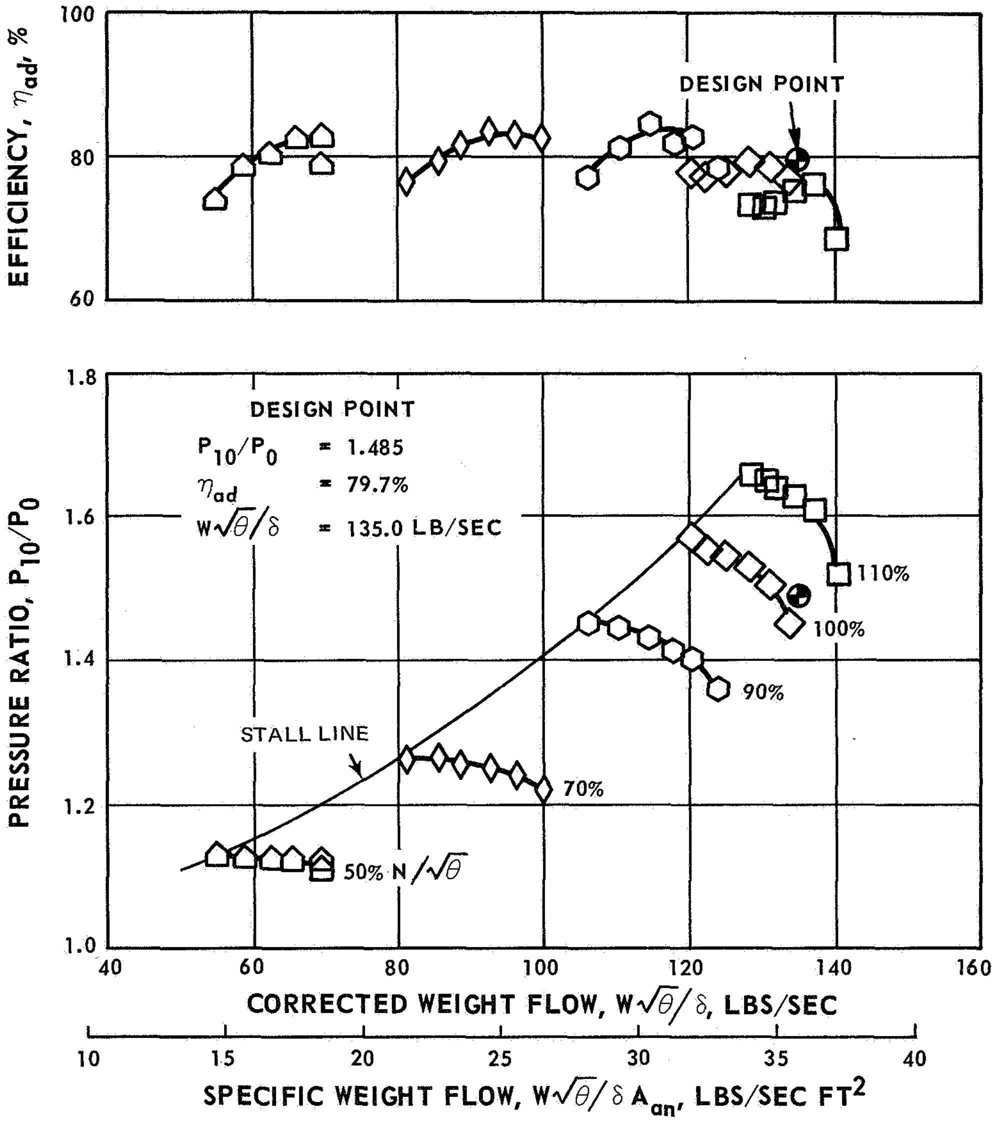


Figure 14 Over-All Performance of Inlet Guide Vane, Rotor, and MCA Stator A (Slotted)

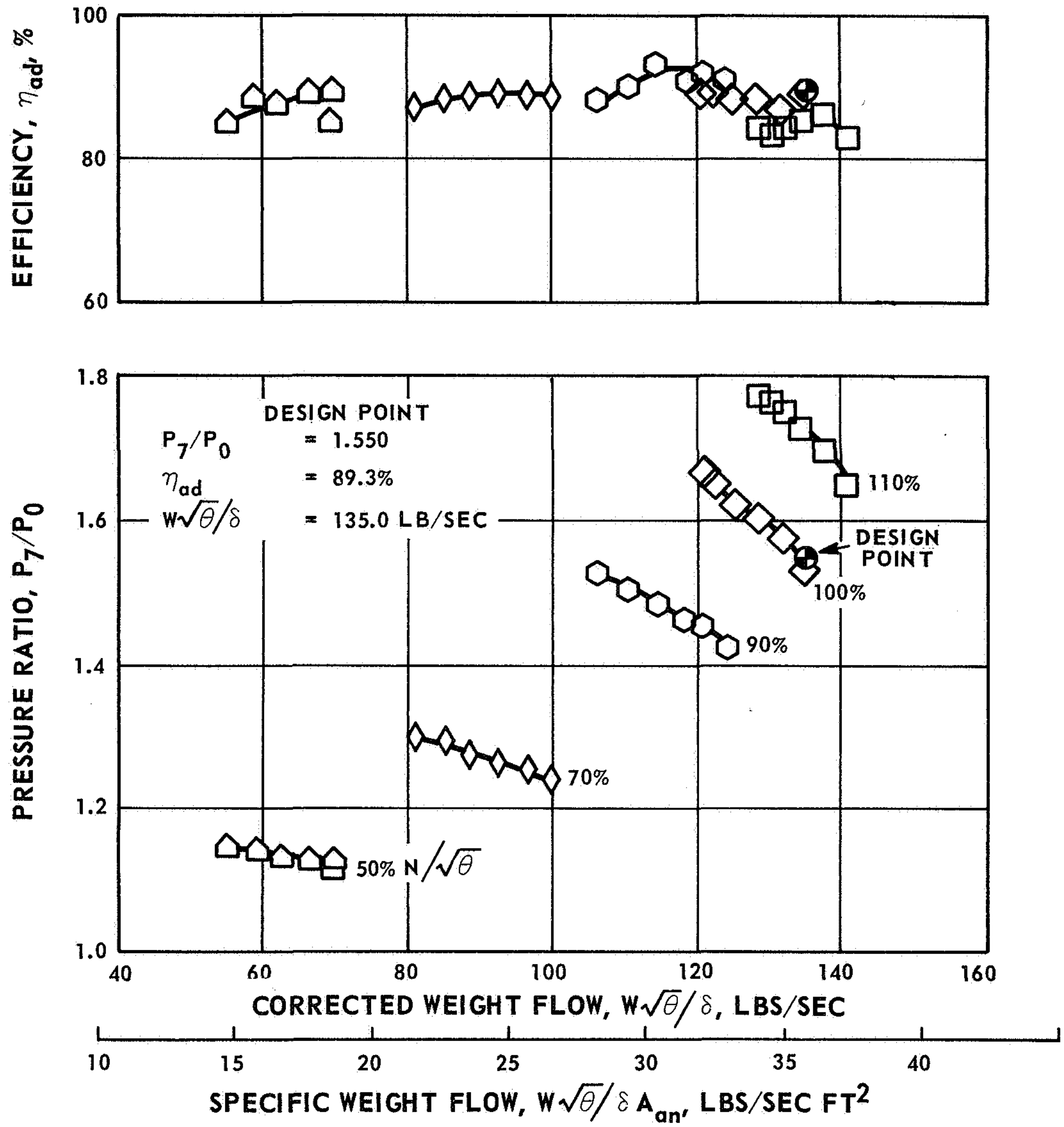
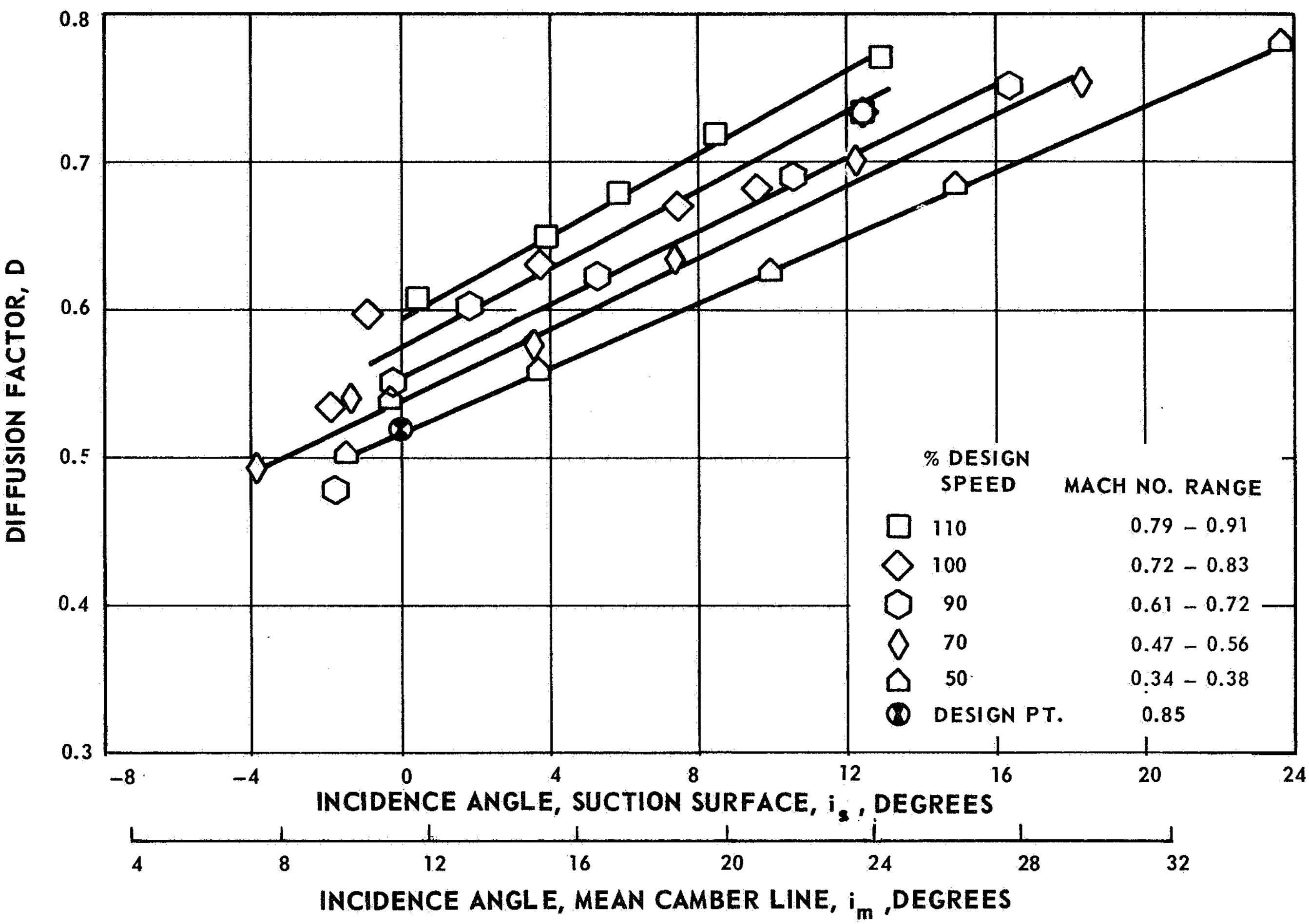
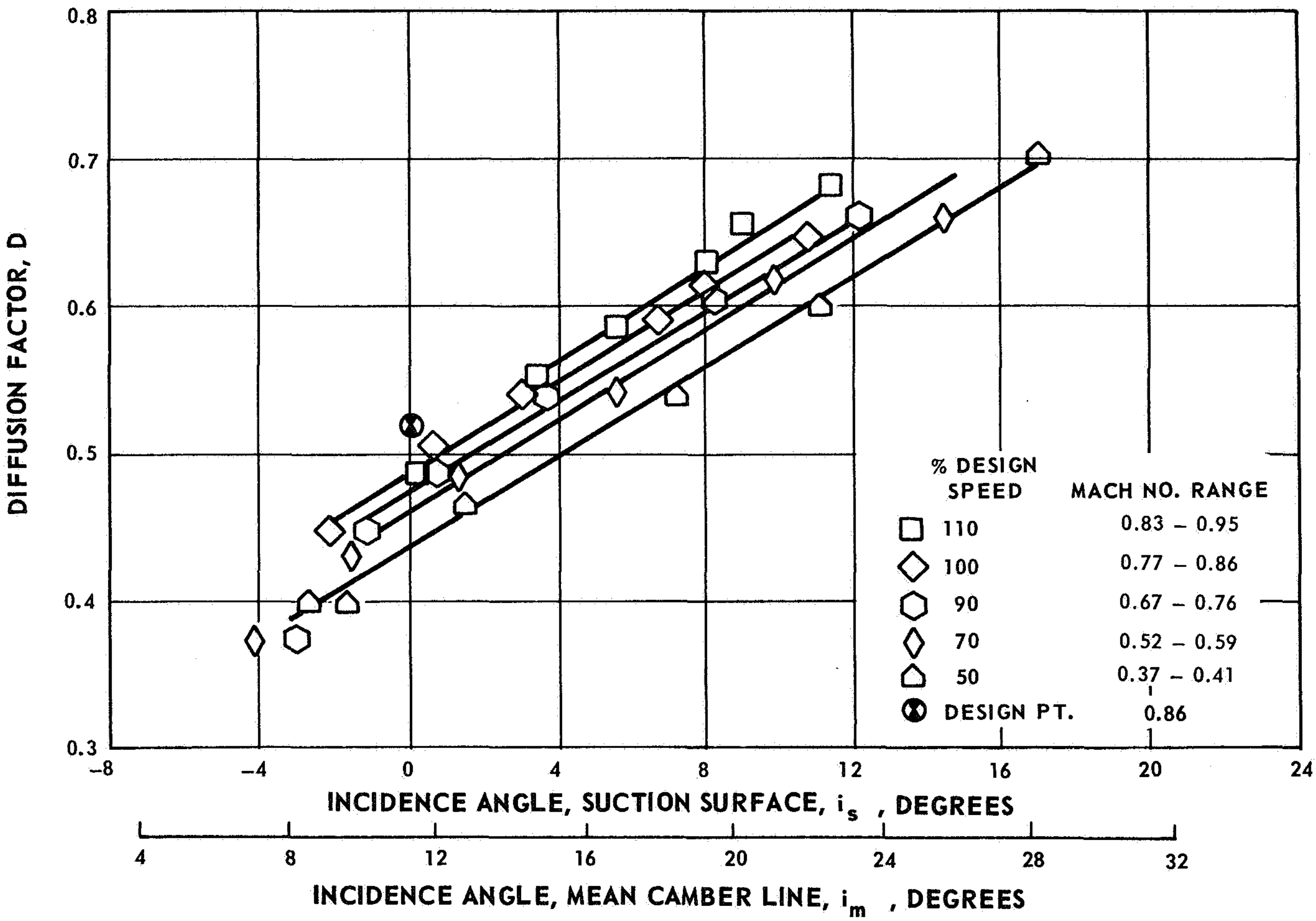


Figure 15 Over-All Performance of Inlet Guide Vane and Rotor



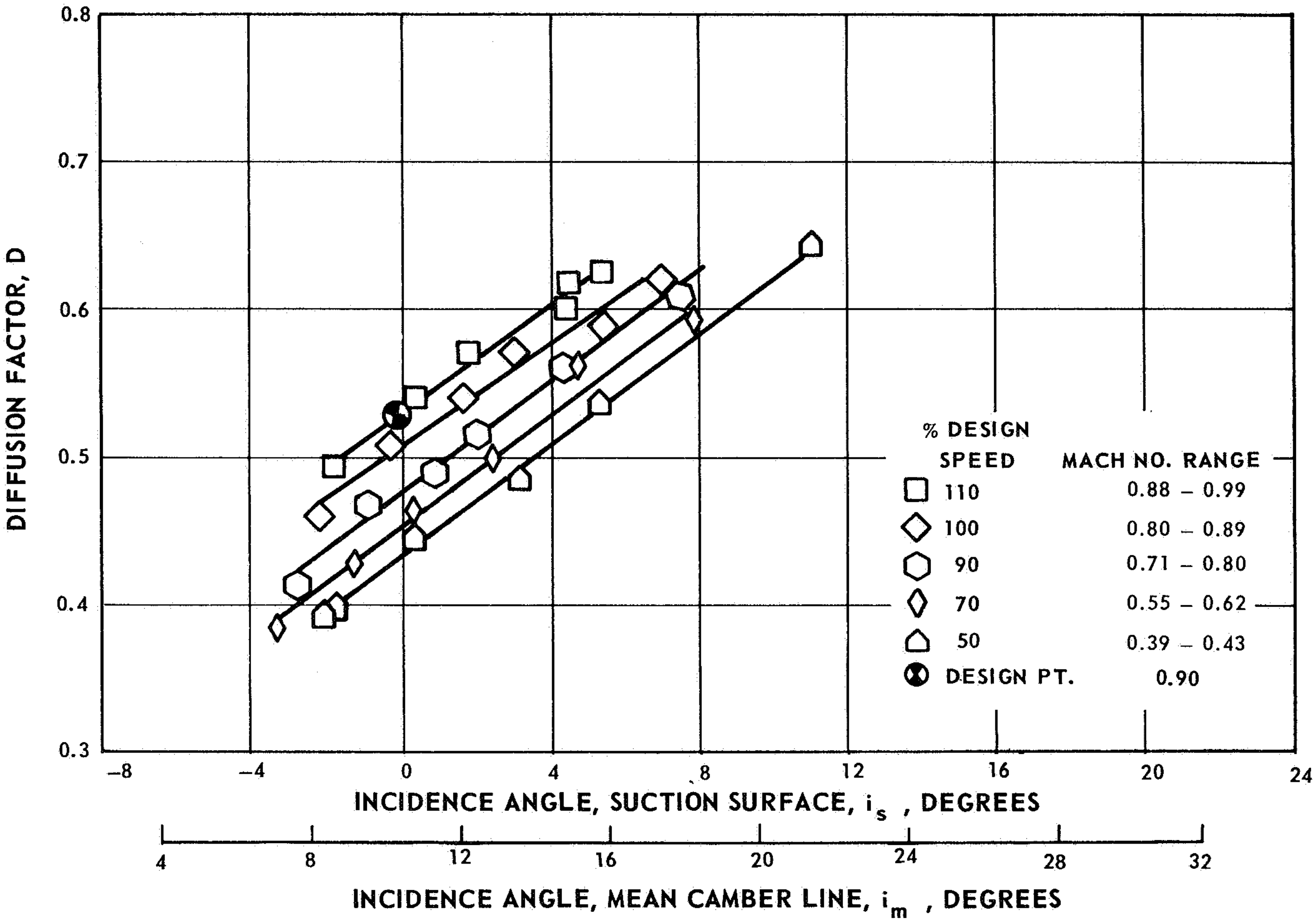
a) 5% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



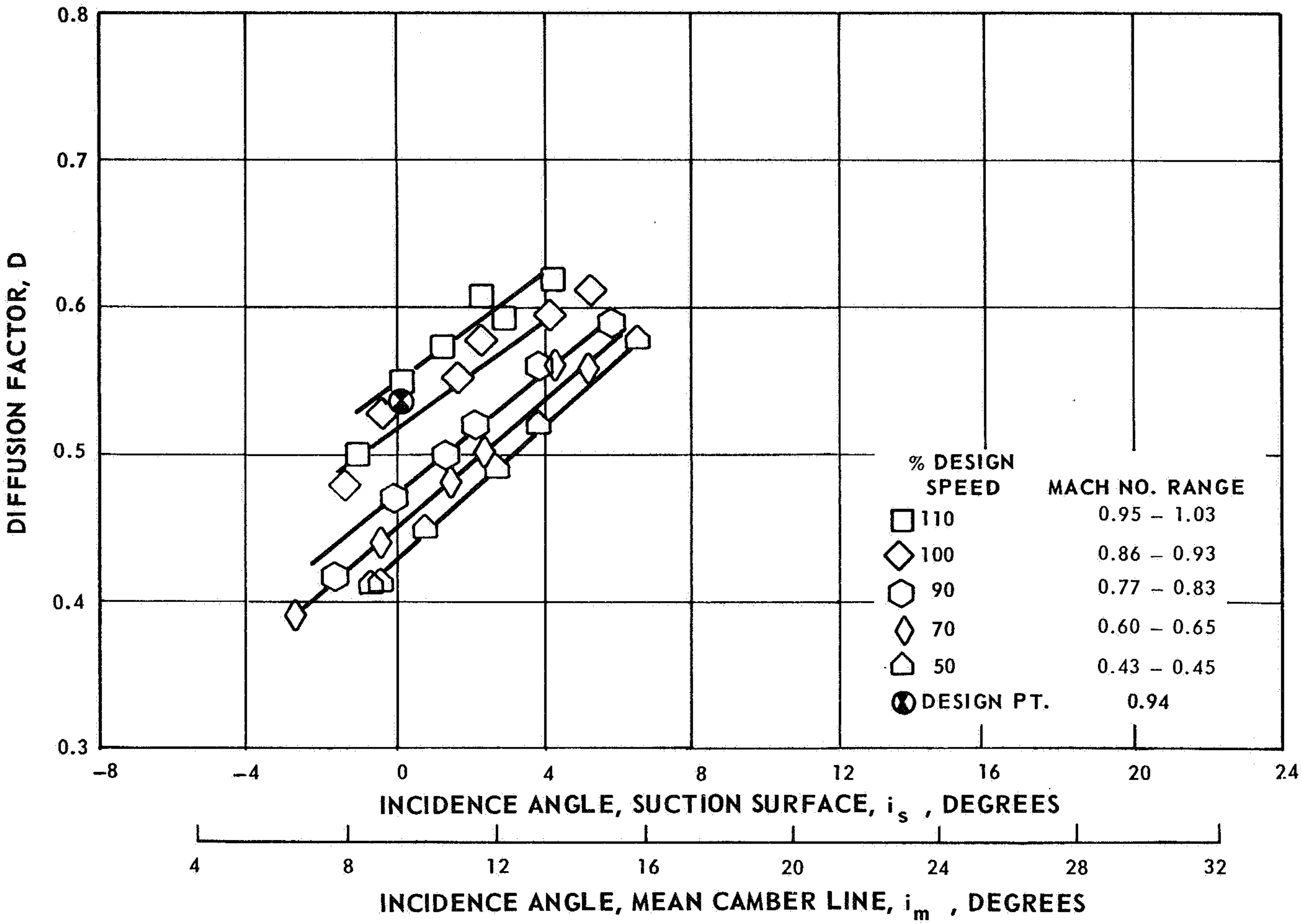
b) 10% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



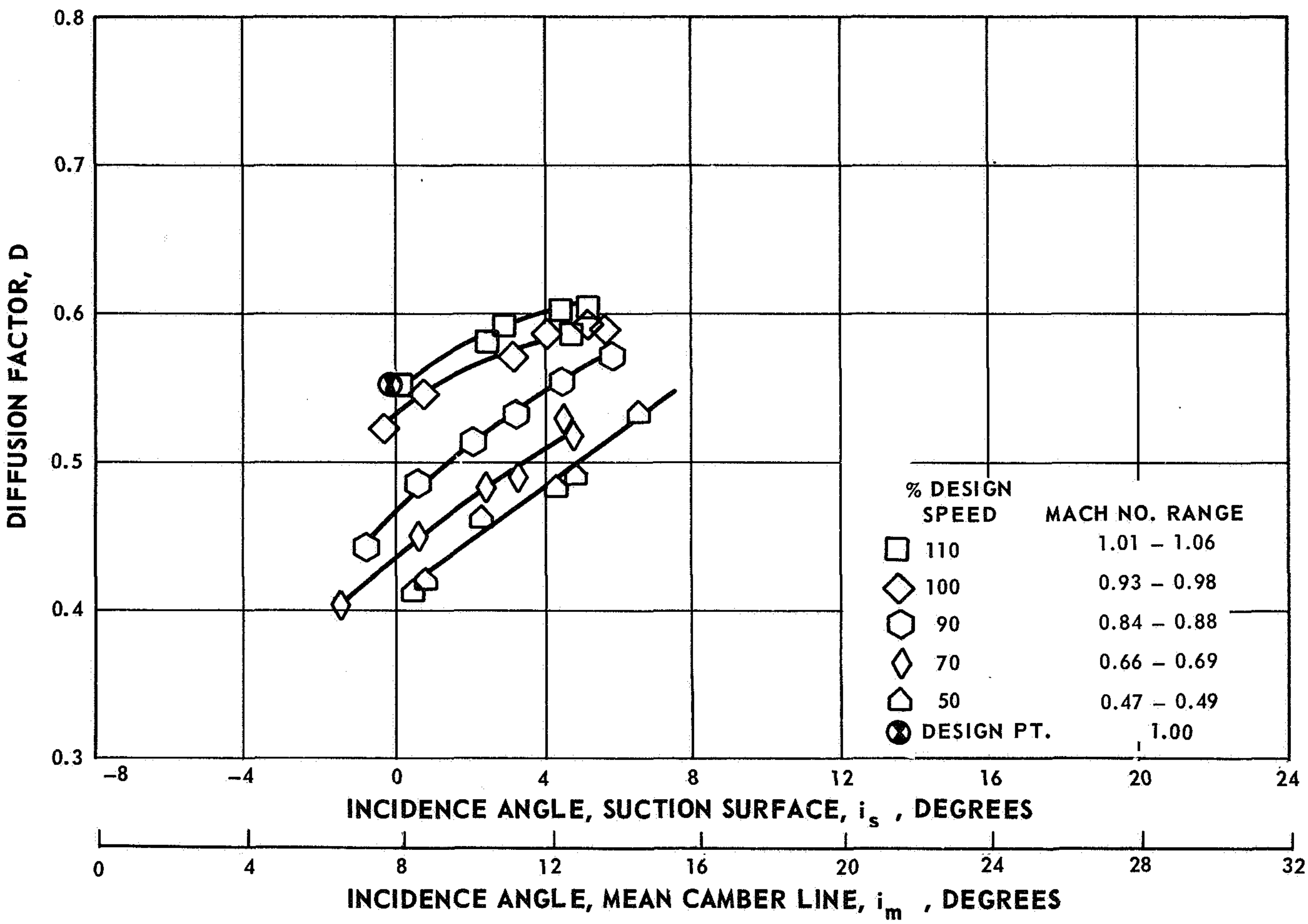
c) 30% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



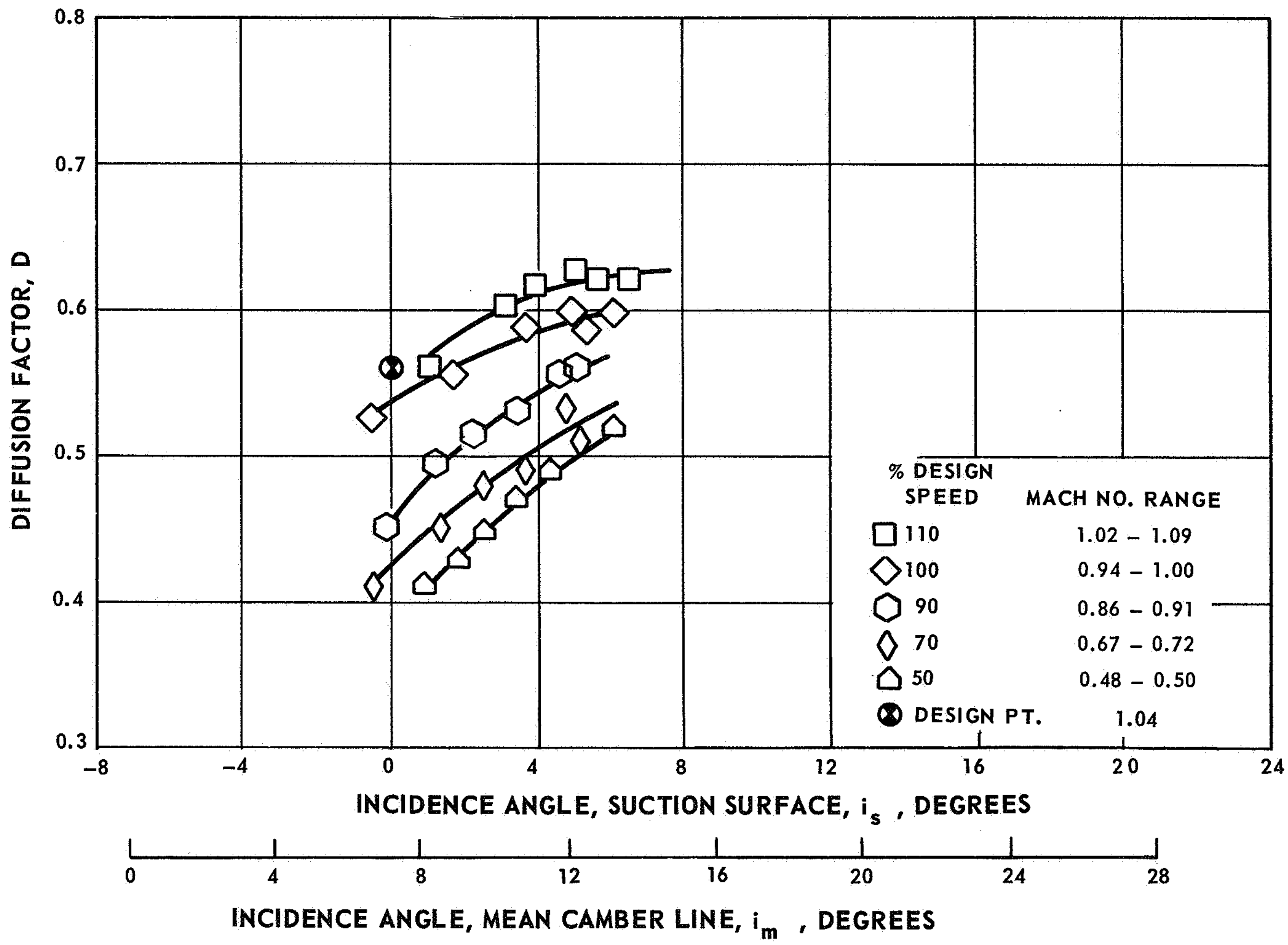
d) 50% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



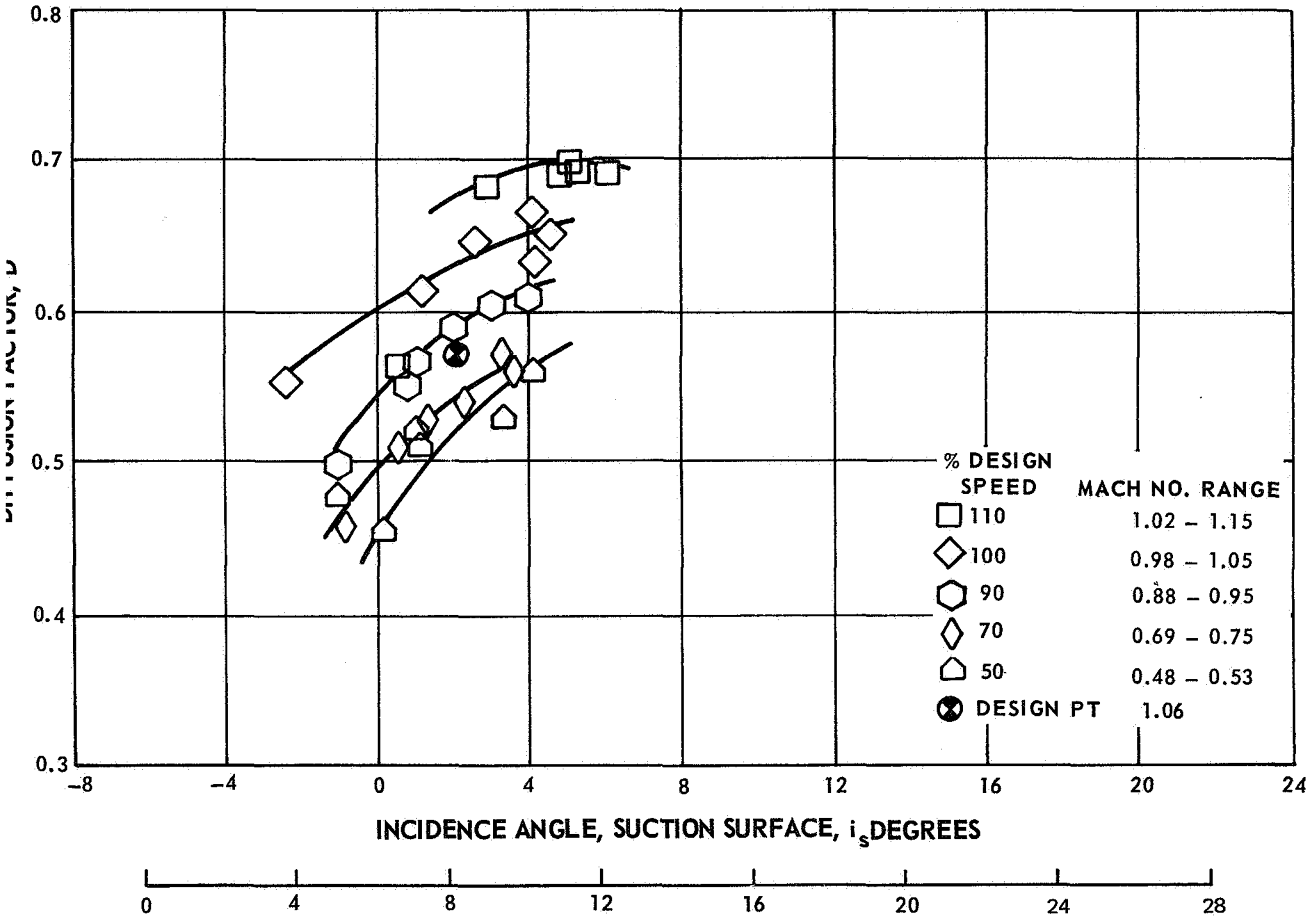
e) 70% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



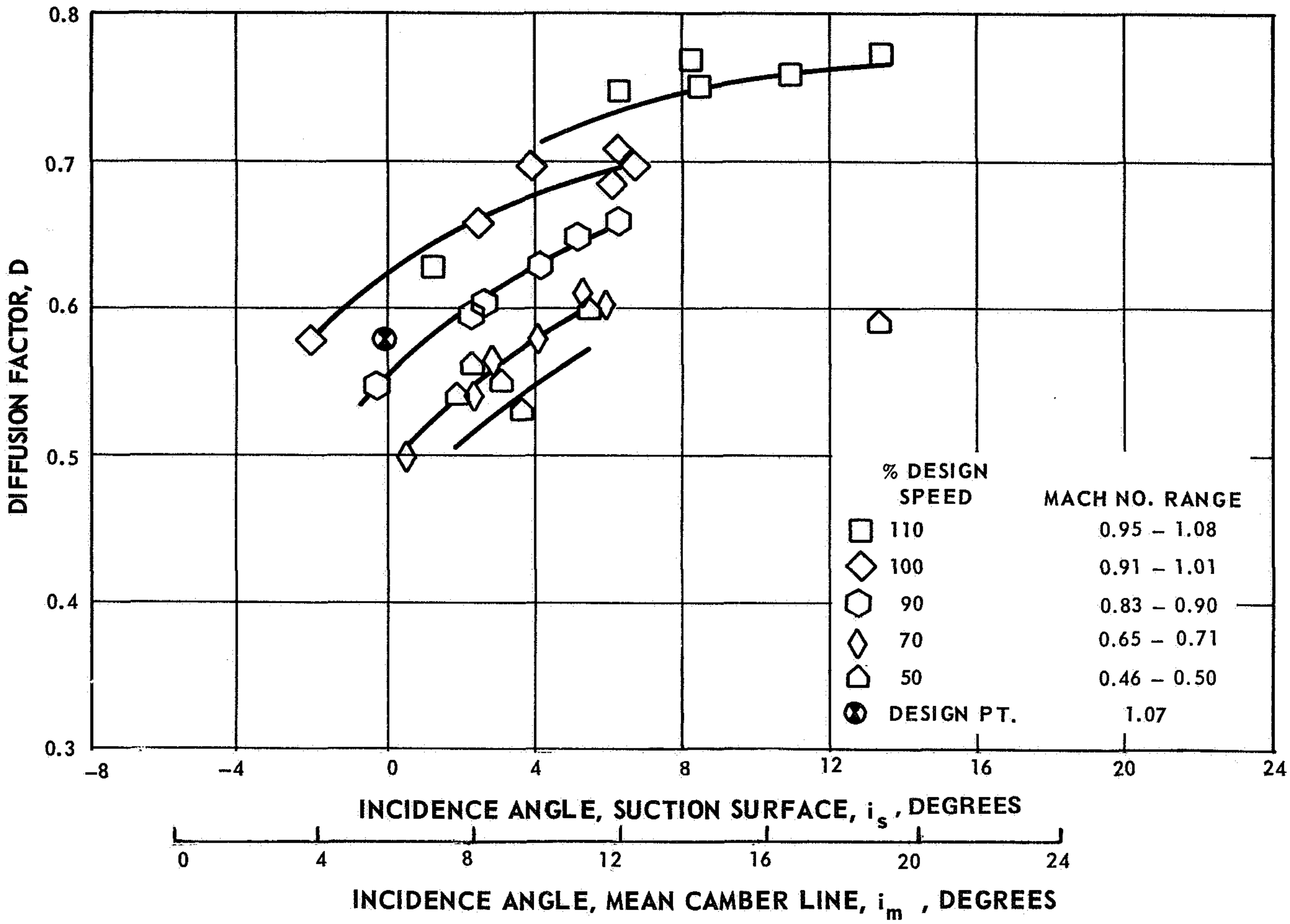
f) 80% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



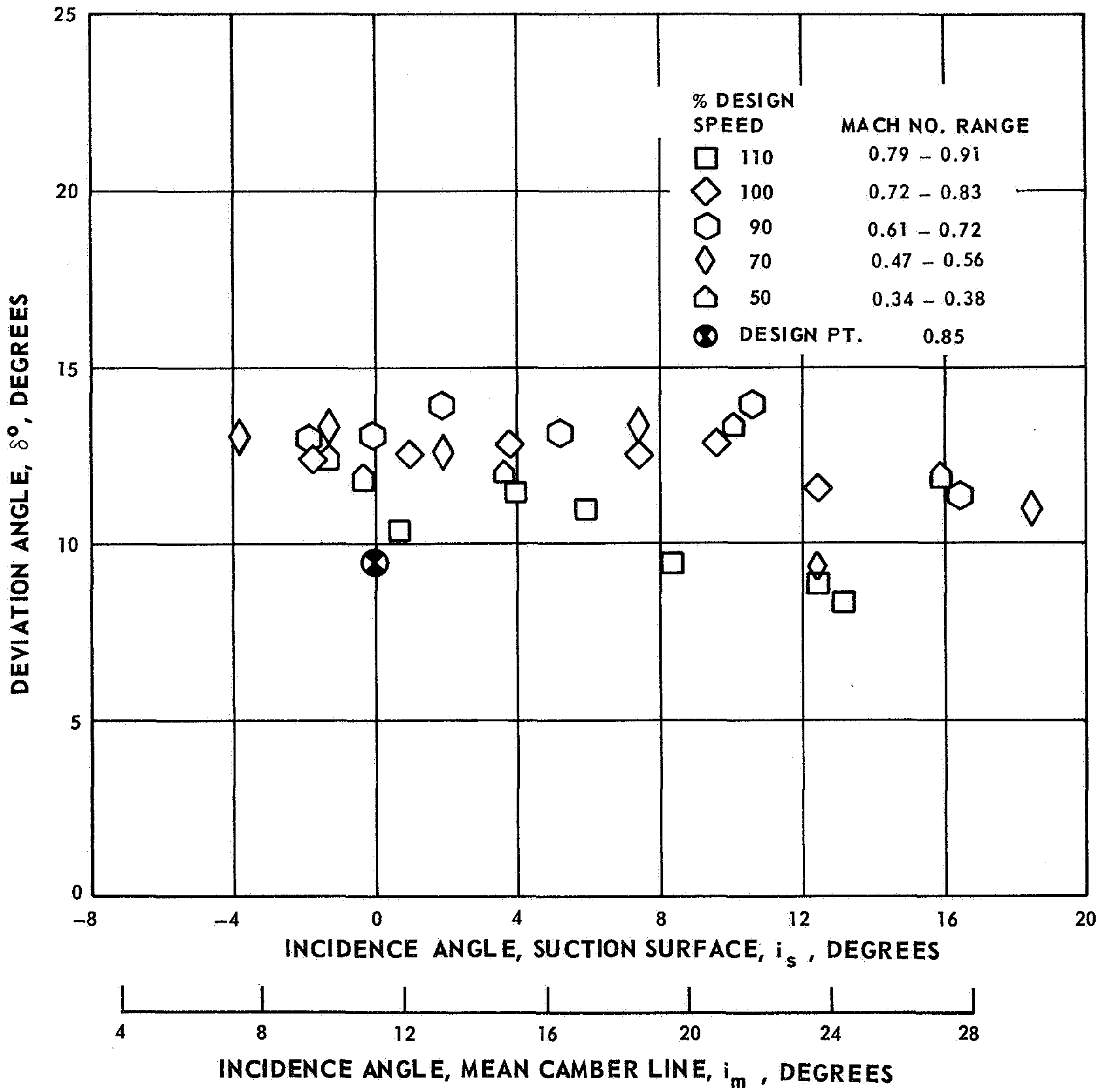
g) 90% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



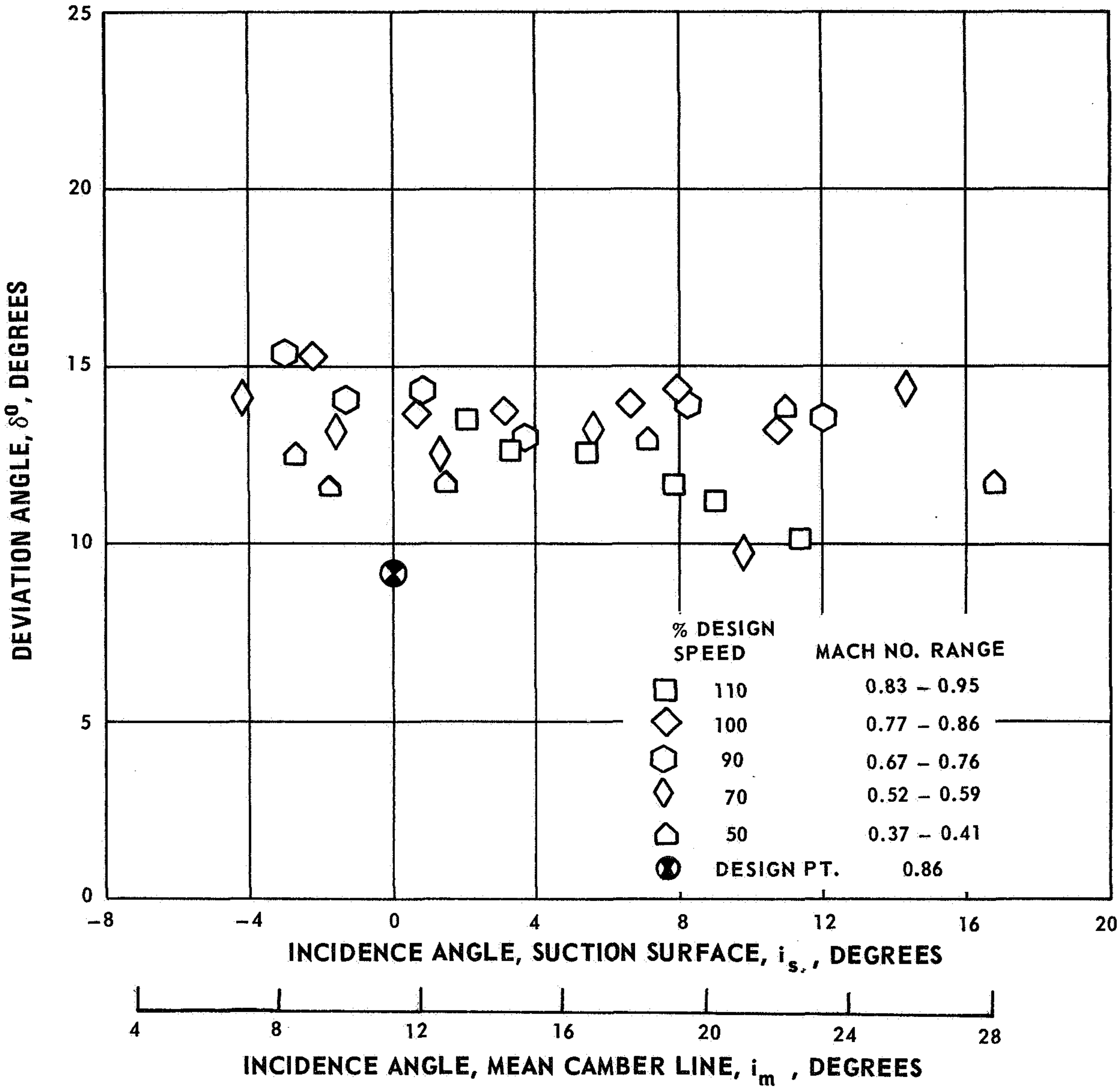
h) 95% SPAN

Figure 16 MCA Stator A (Slotted), Diffusion Factor vs. Incidence



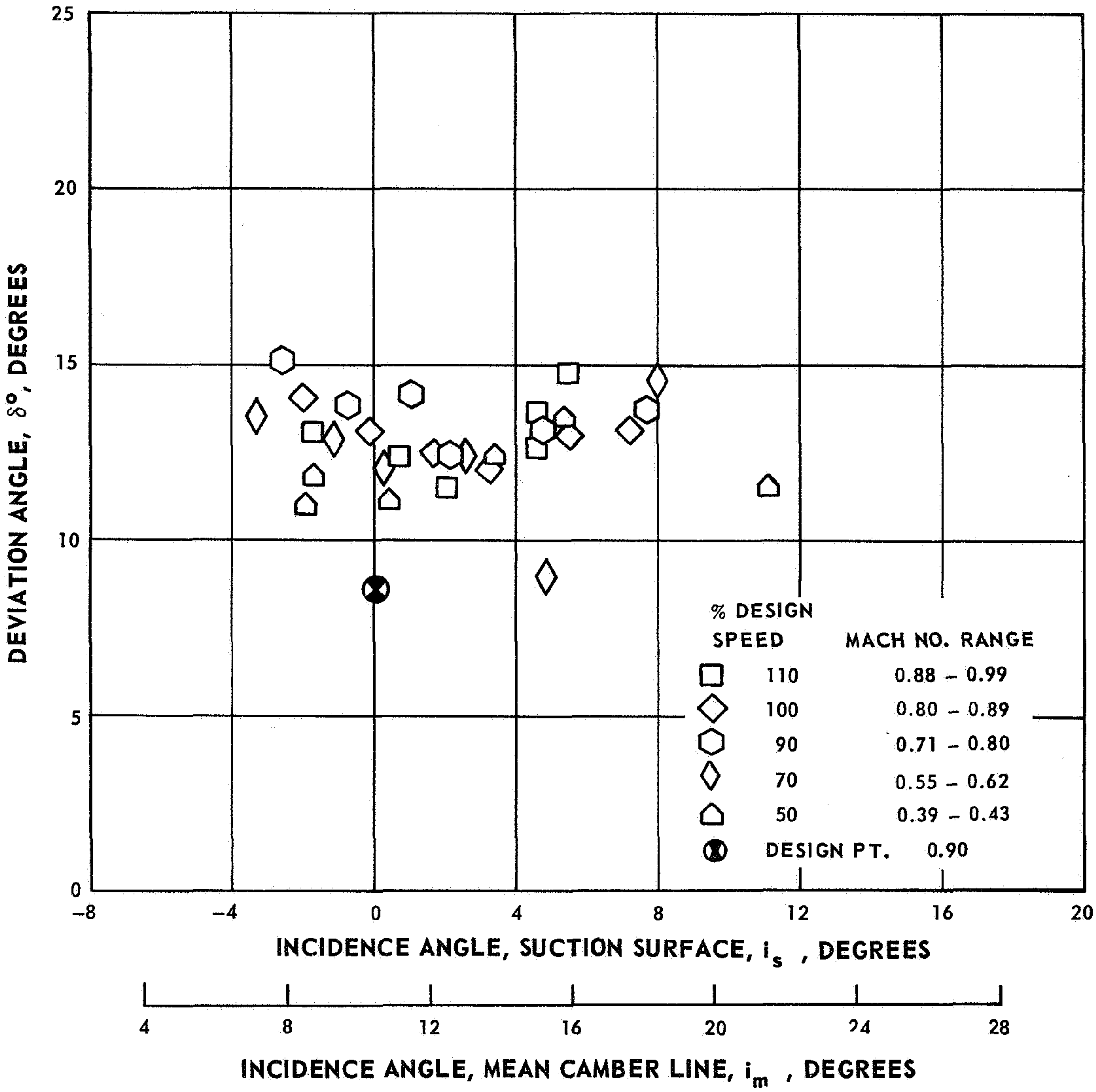
a) 5% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



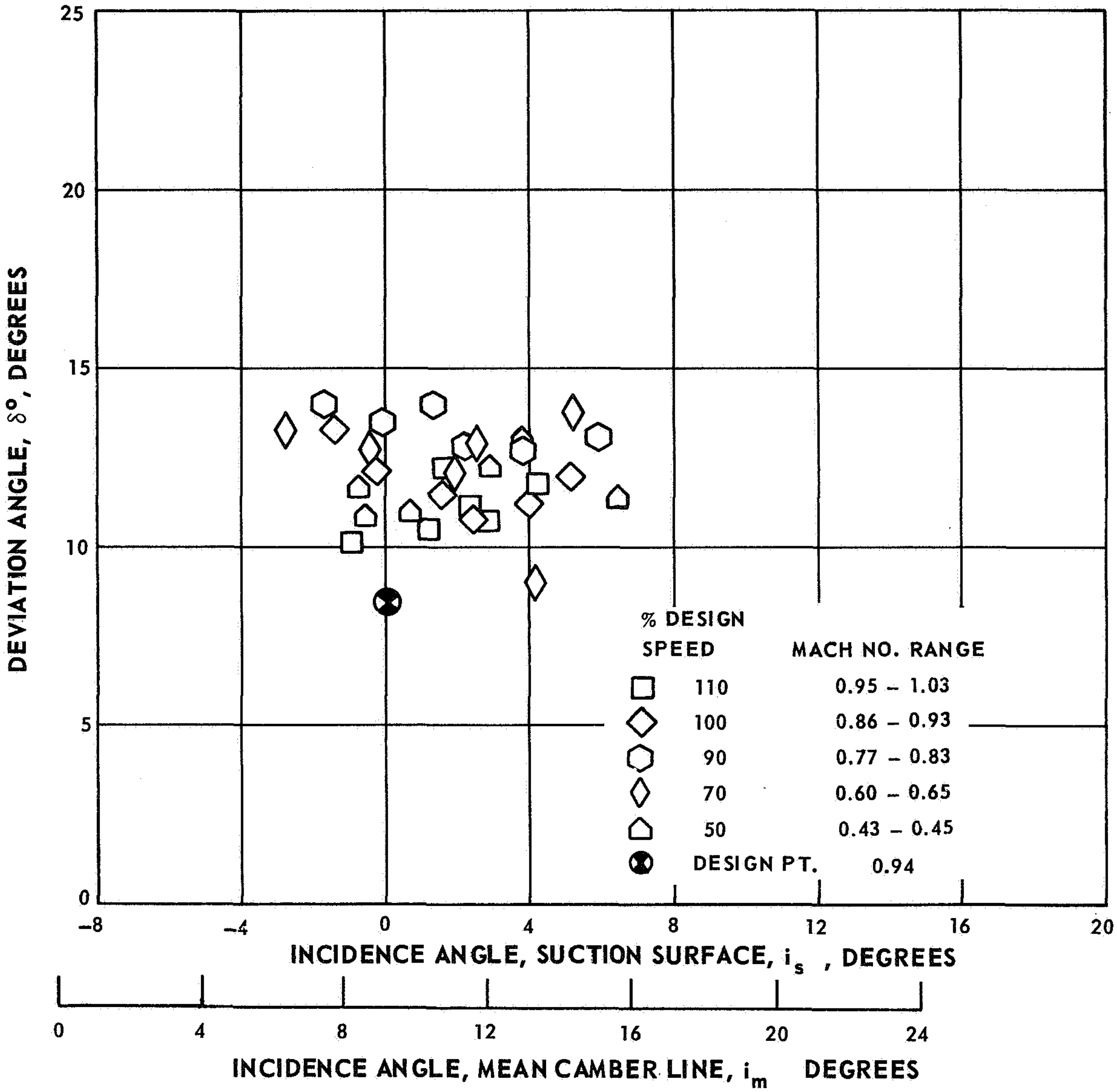
b) 10% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



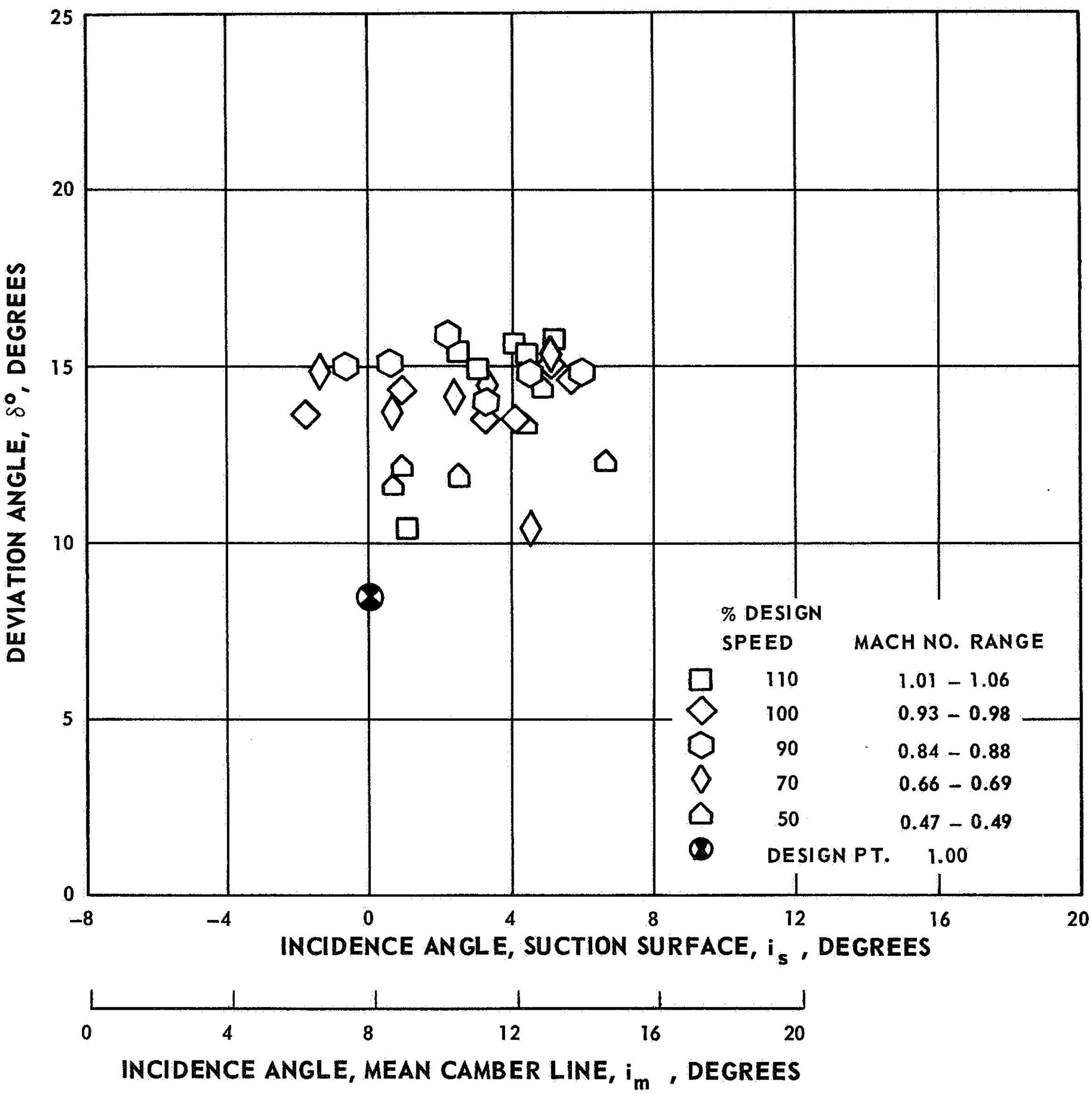
c) 30% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



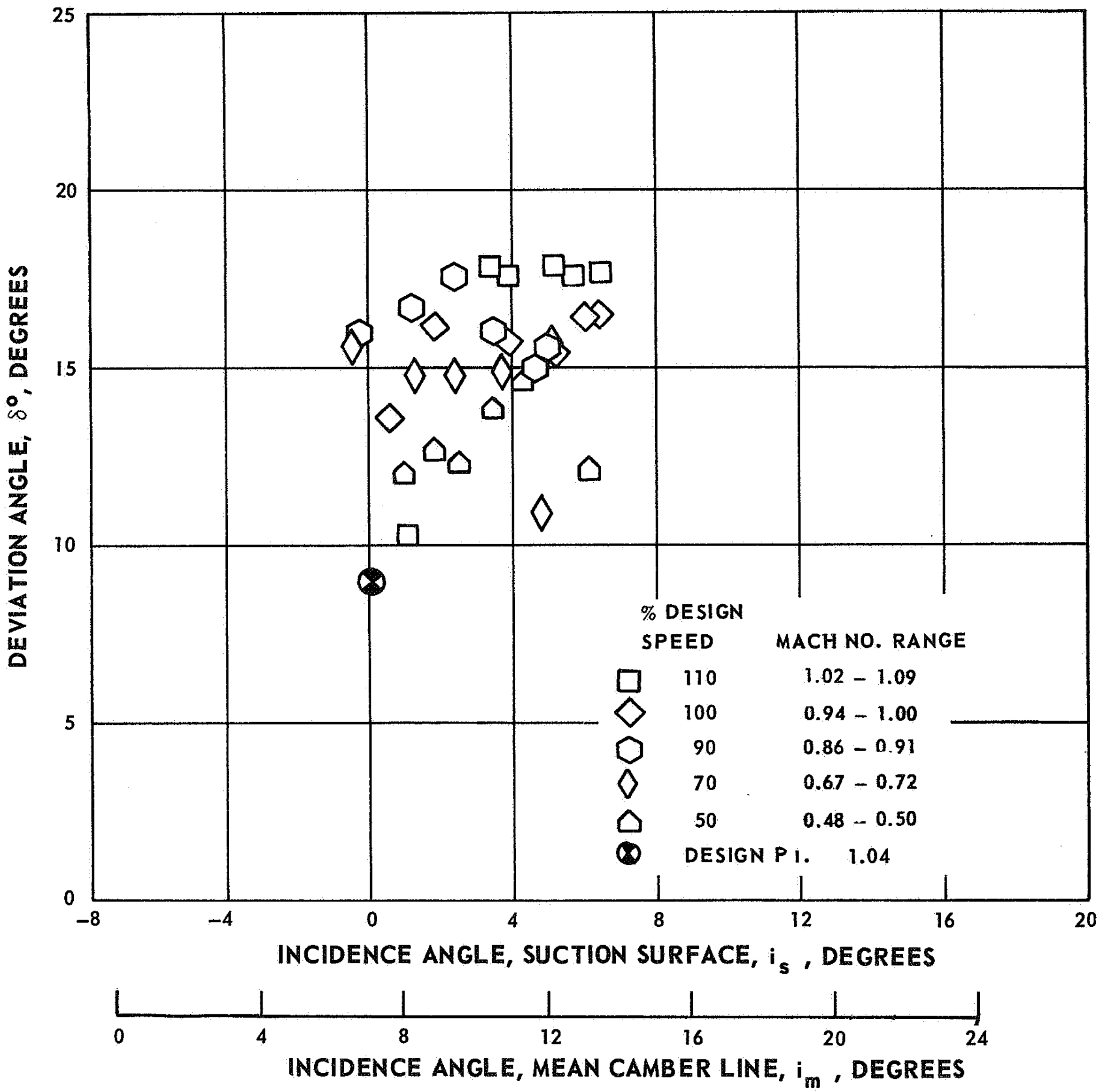
d) 50% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



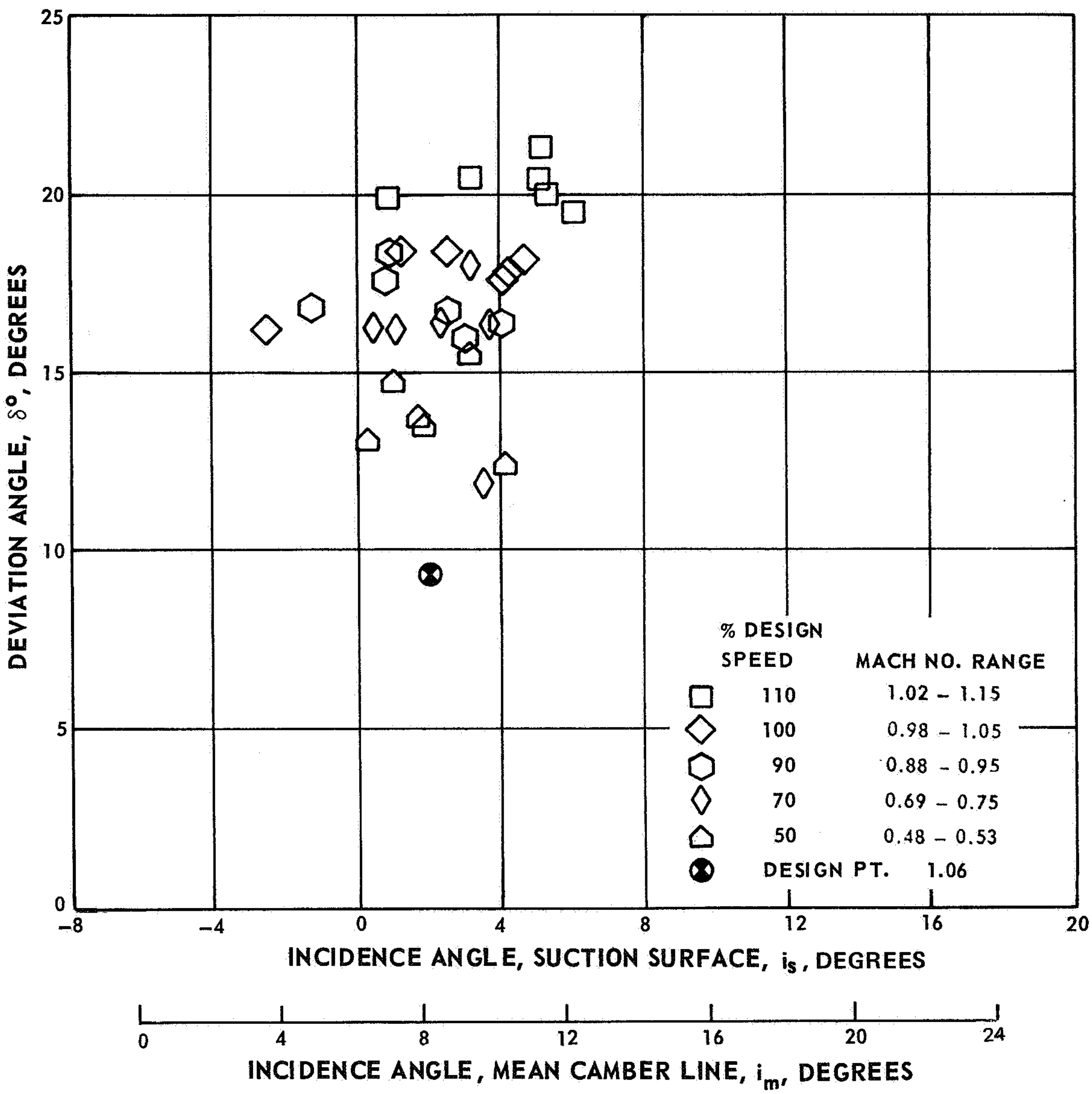
e) 70% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



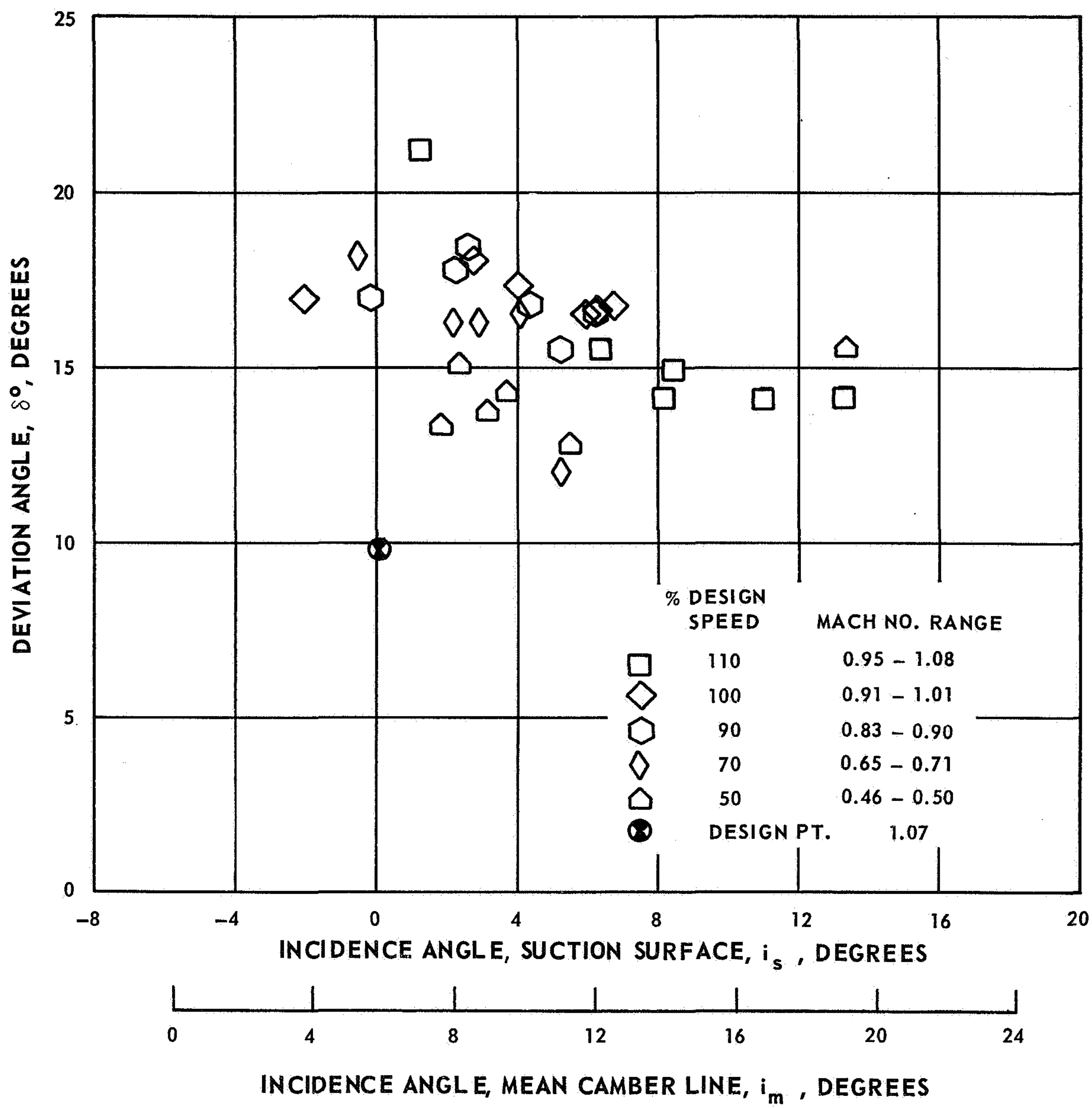
f) 80% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



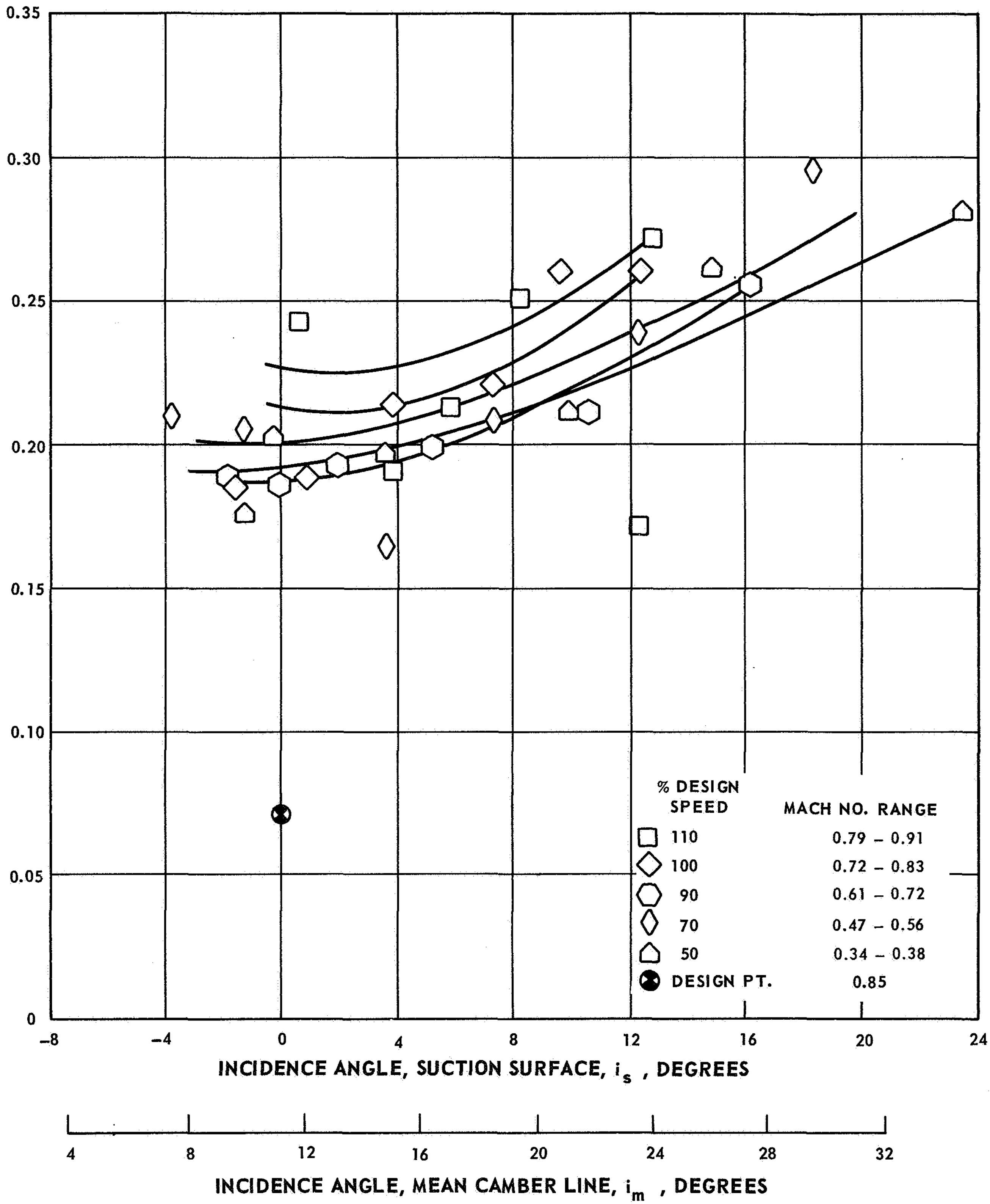
g) 90% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



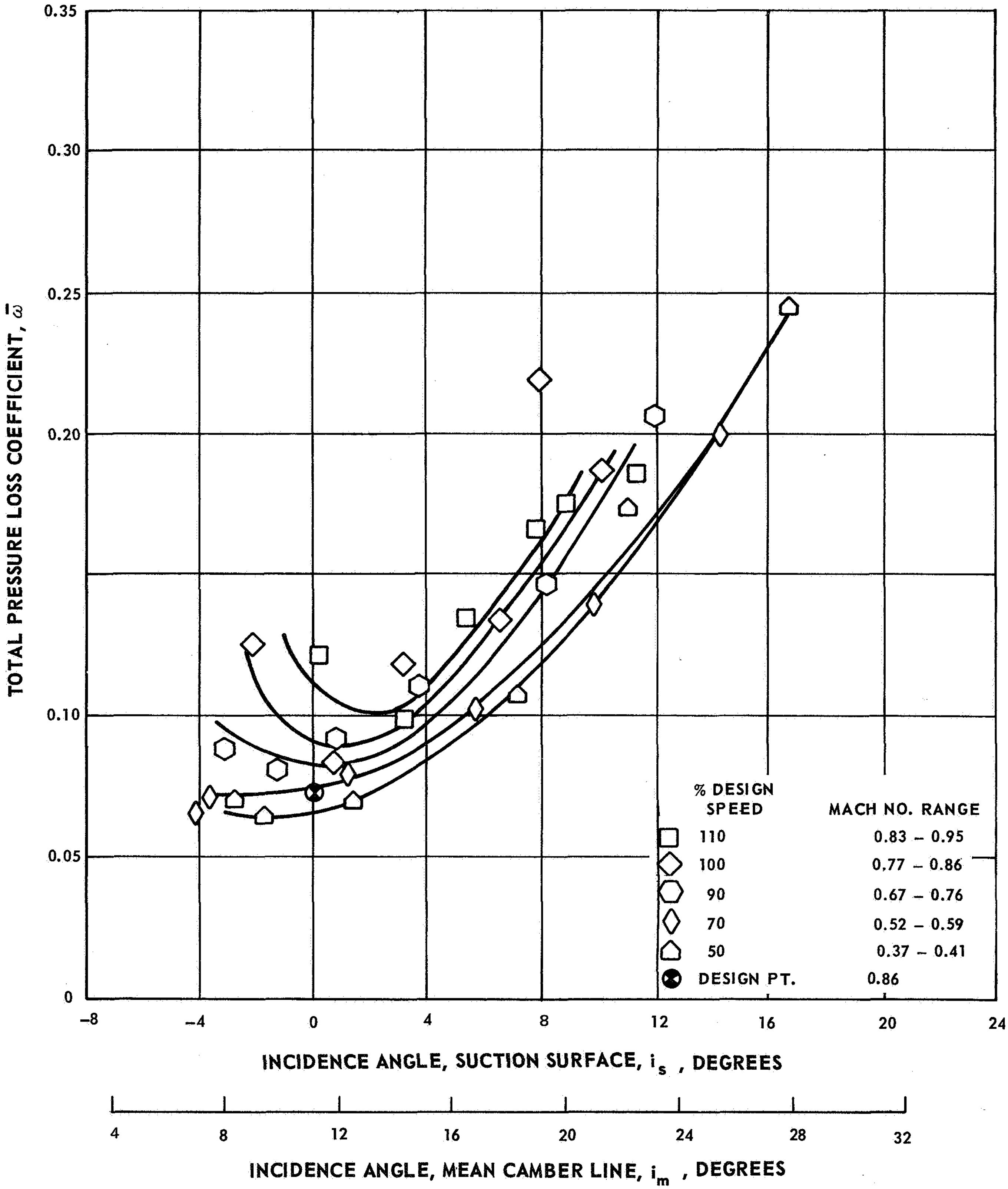
h) 95% SPAN

Figure 17 MCA Stator A (Slotted), Deviation vs. Incidence



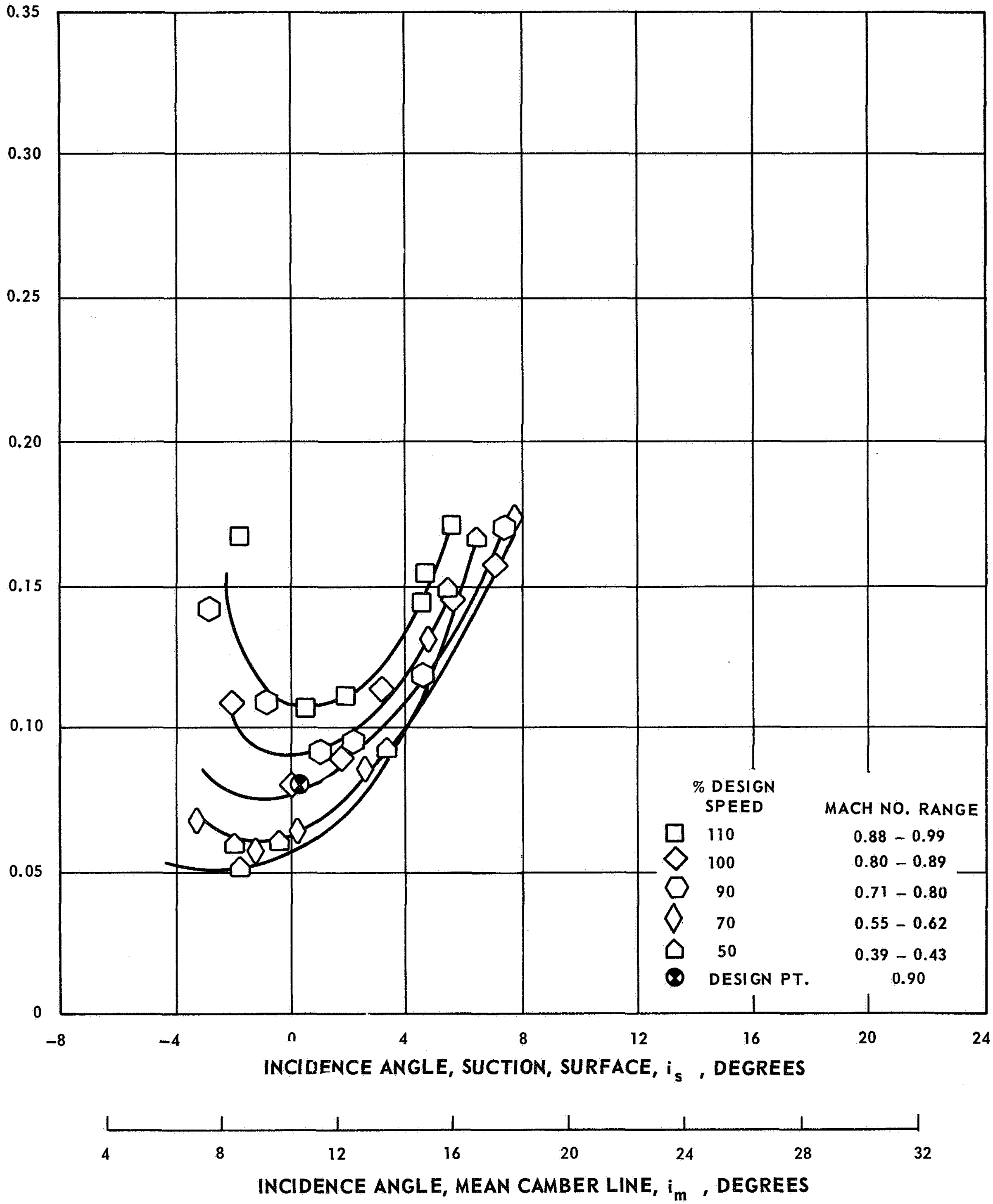
a) 5% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



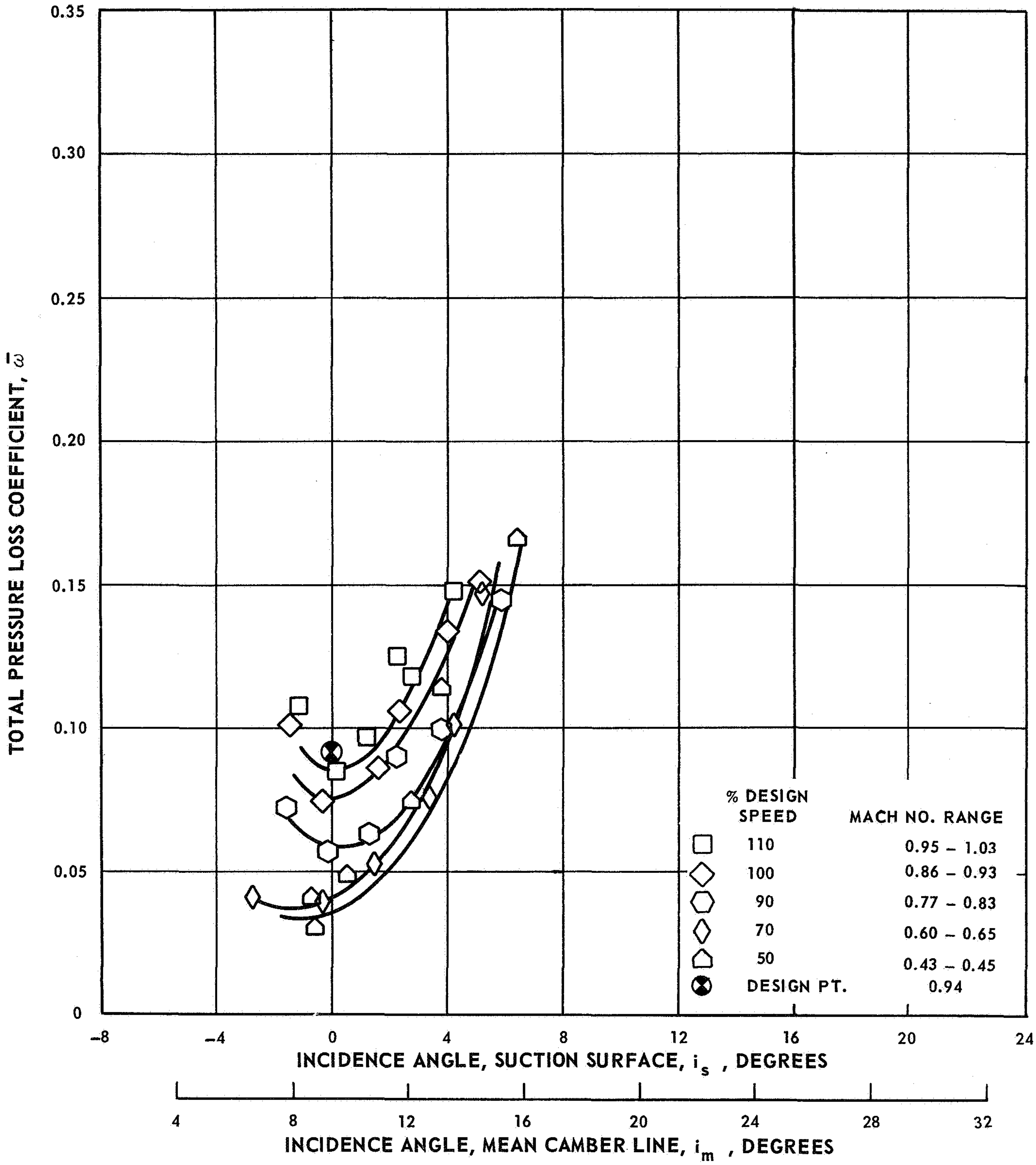
b) 10% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



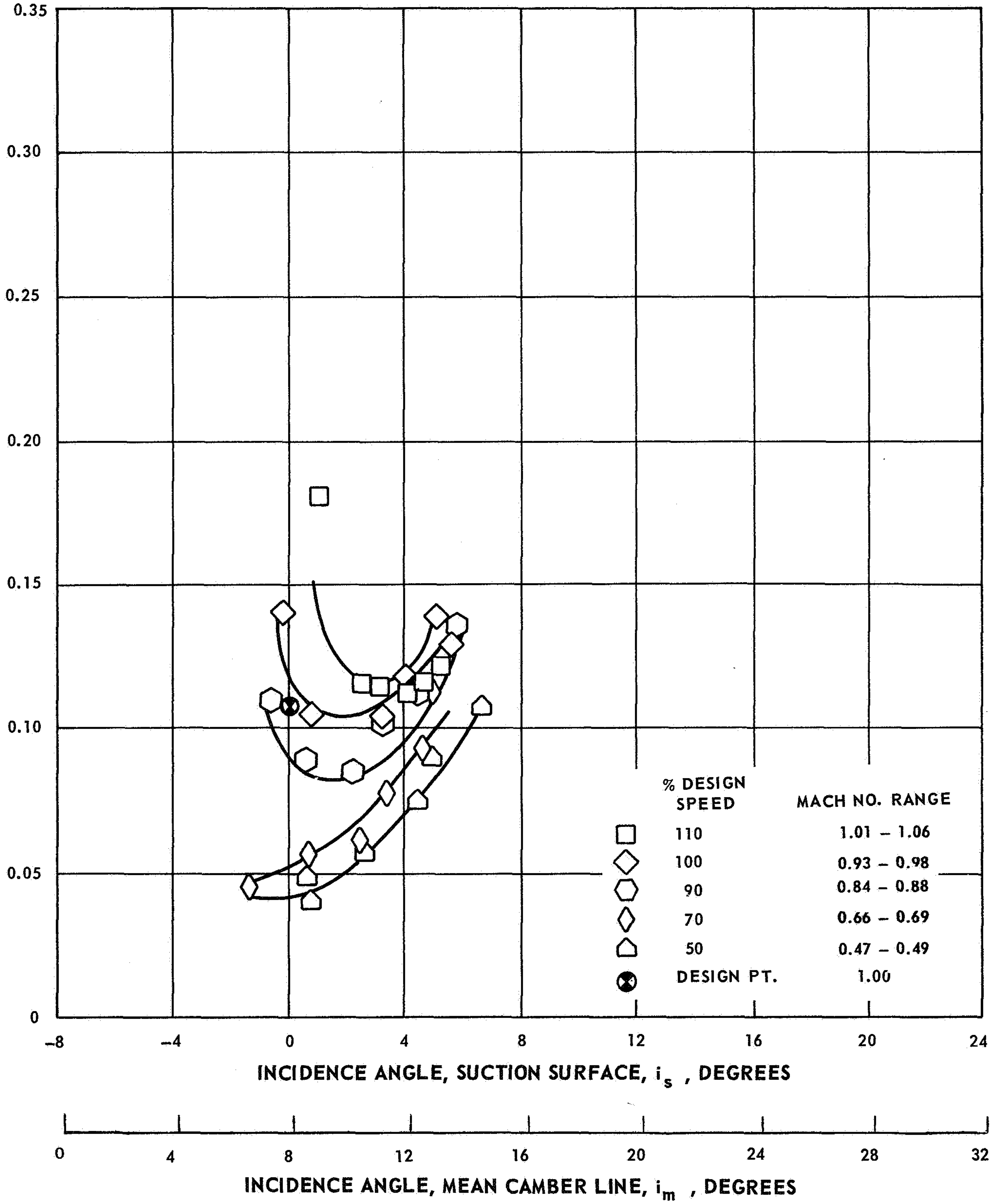
c) 30% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



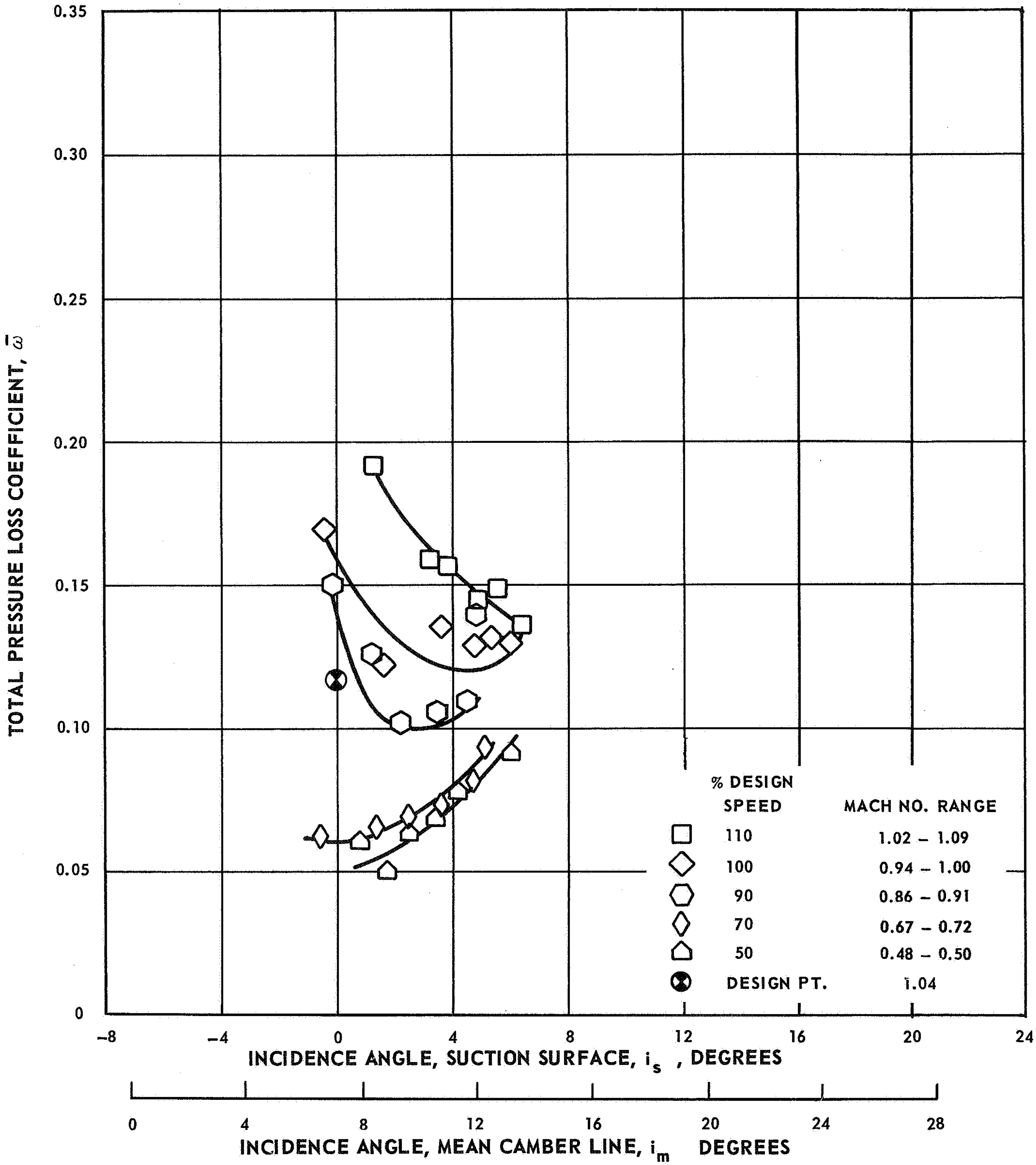
d) 50% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



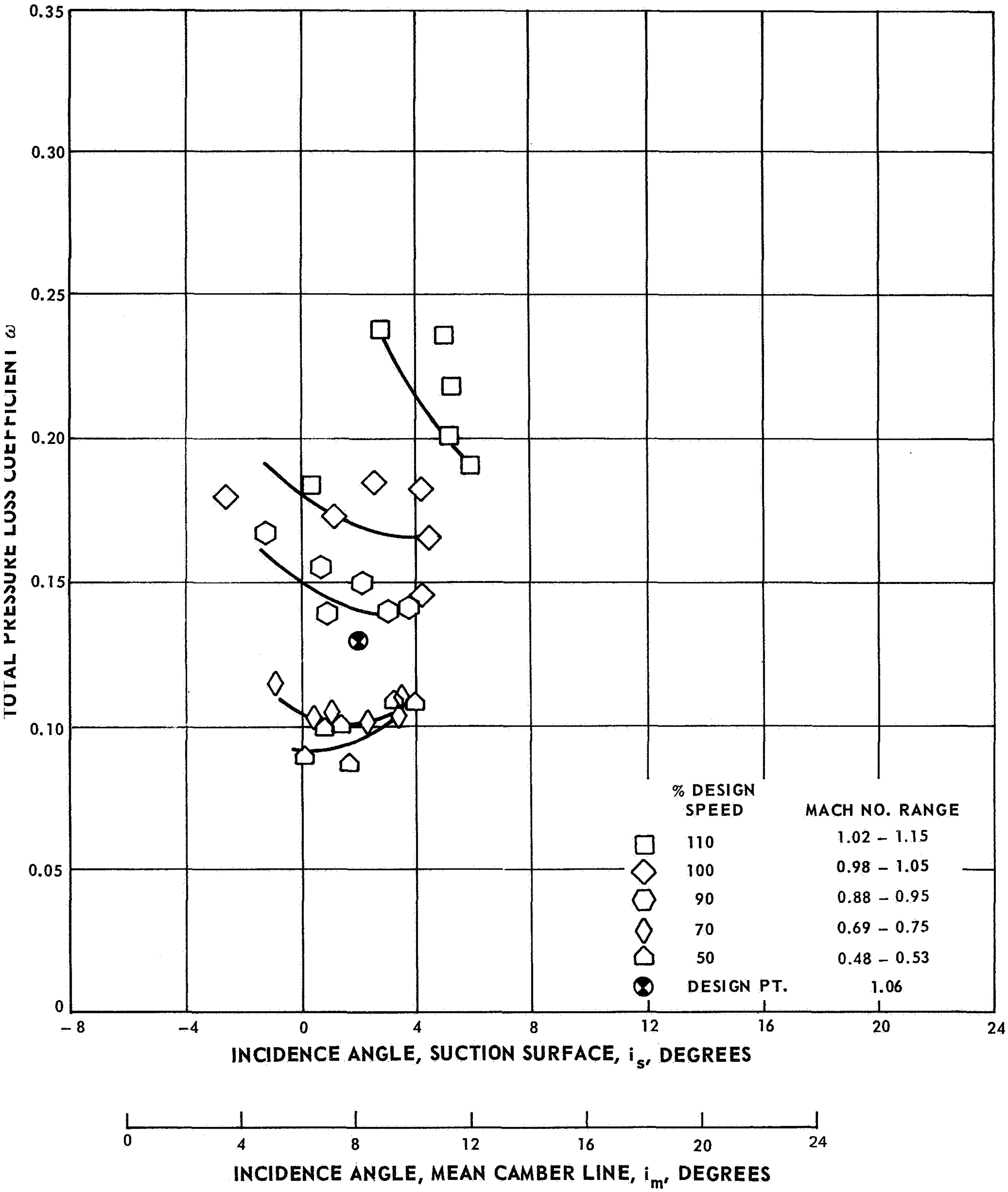
e) 70% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



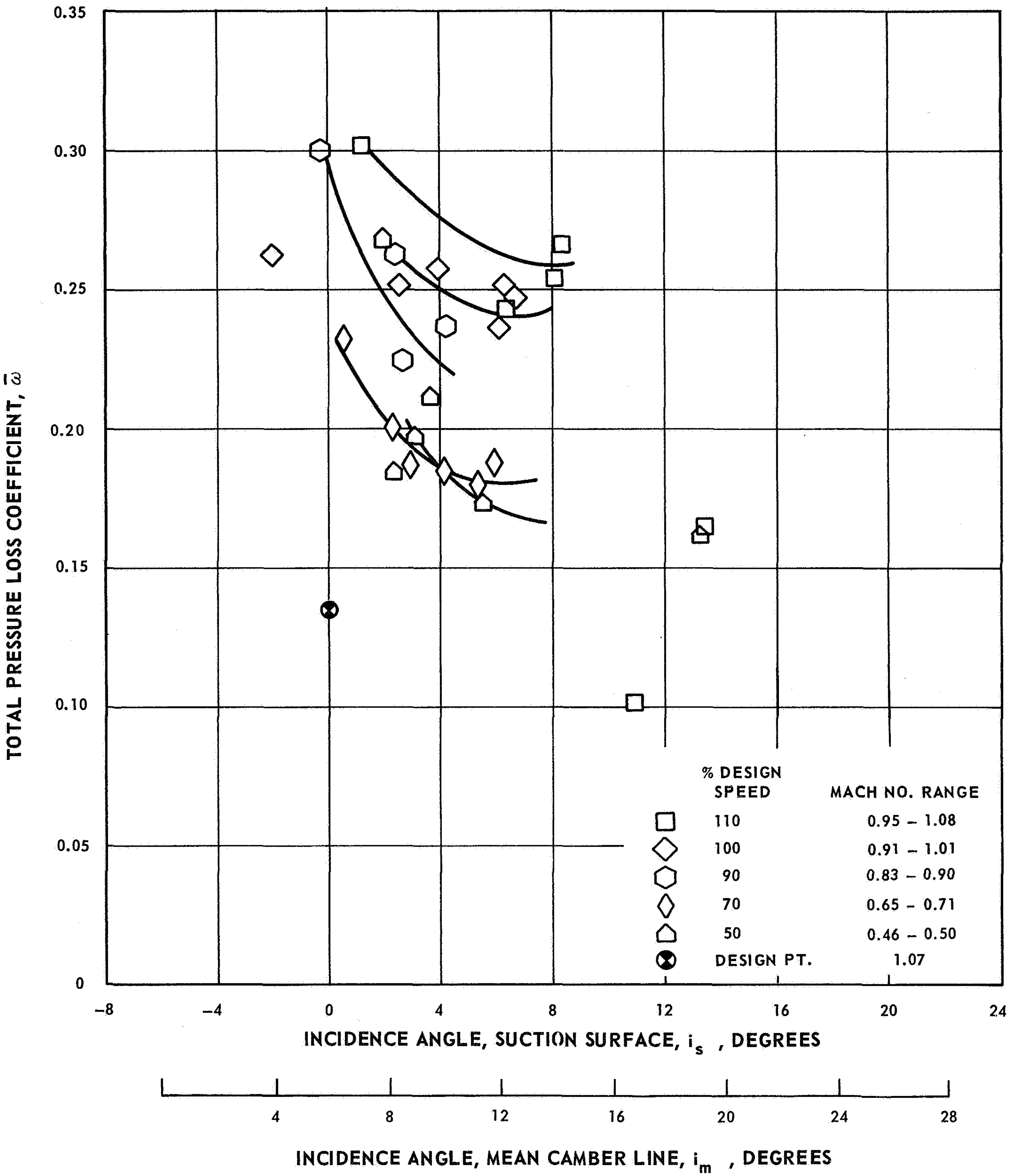
f) 80% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



g) 90% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence



h) 95% SPAN

Figure 18 MCA Stator A (Slotted), Total Pressure Loss Coefficient vs. Incidence

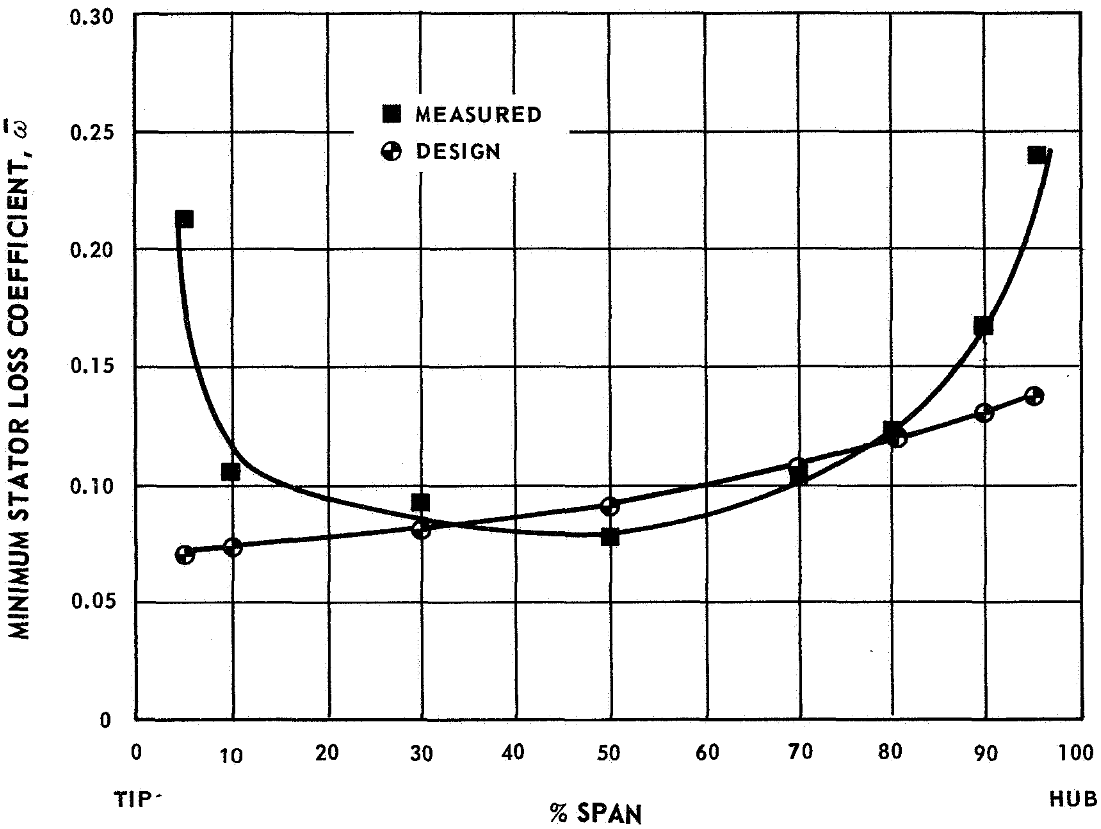
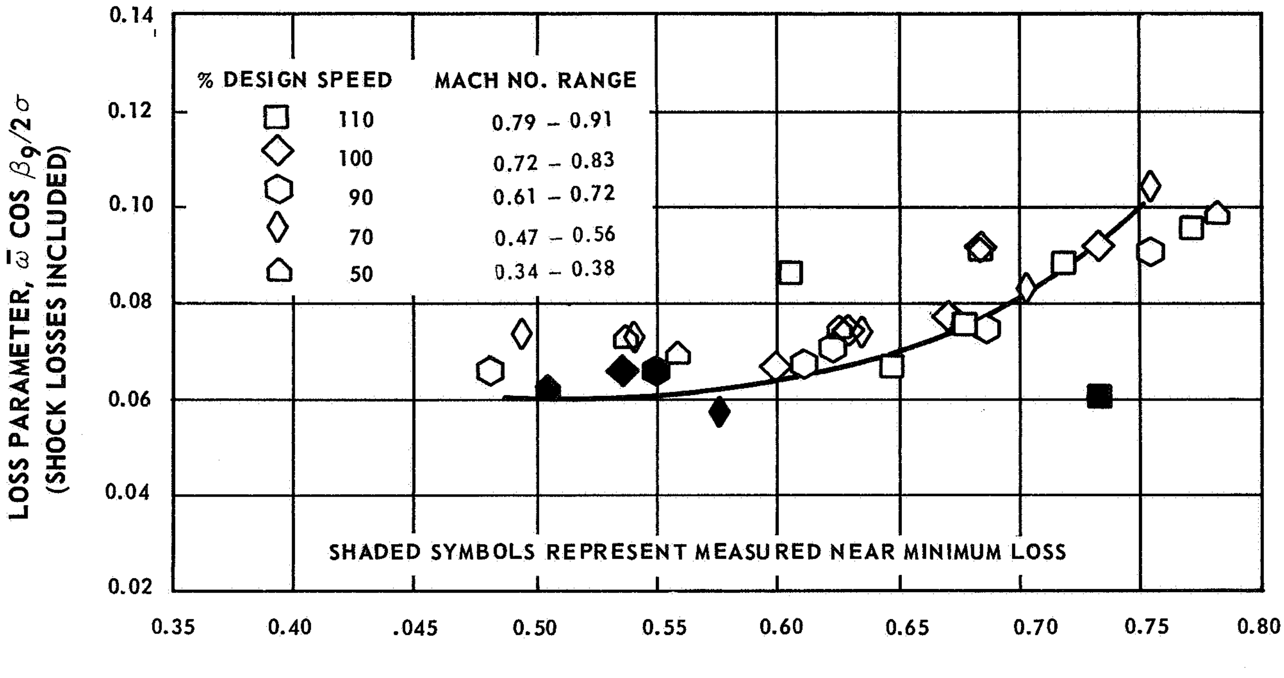
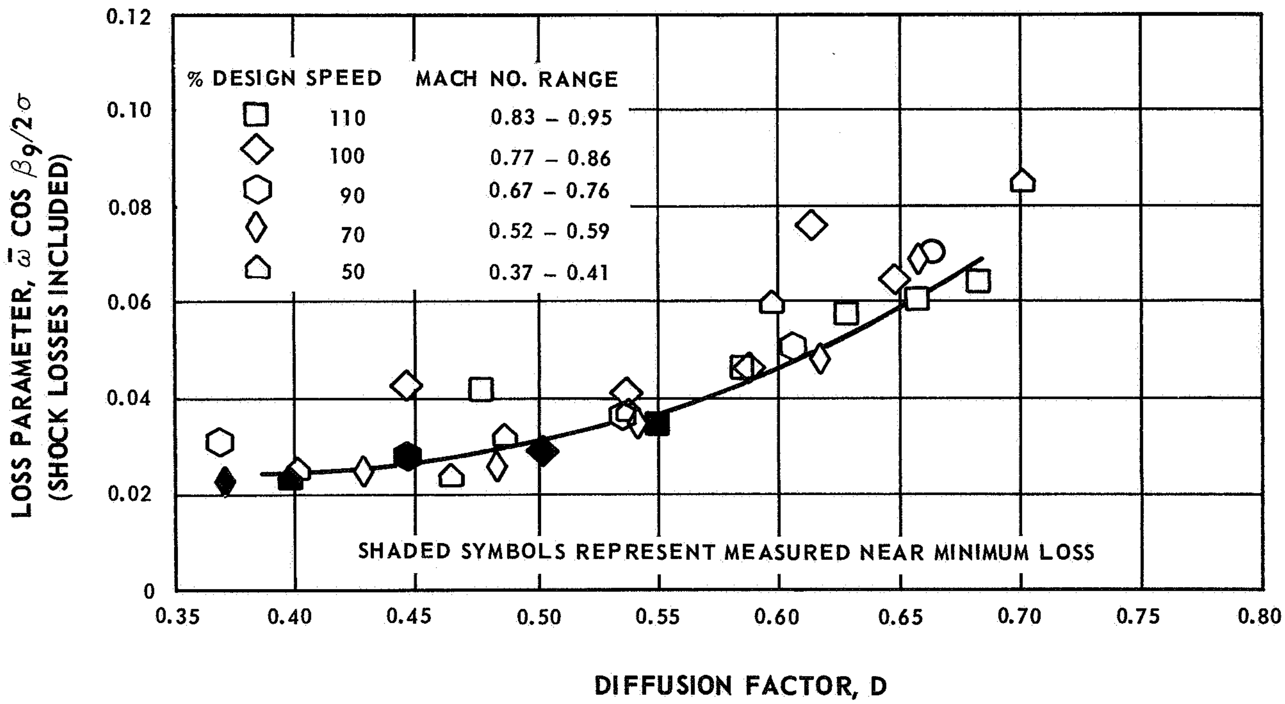


Figure 19 MCA Stator A (Slotted),Mimimum Loss Coefficient vs. Percent Span, 100% Design Speed



a) 5% SPAN



b) 10% SPAN

Figure 20 MCA Stator A (Slotted), Loss Parameter vs. Diffusion Factor

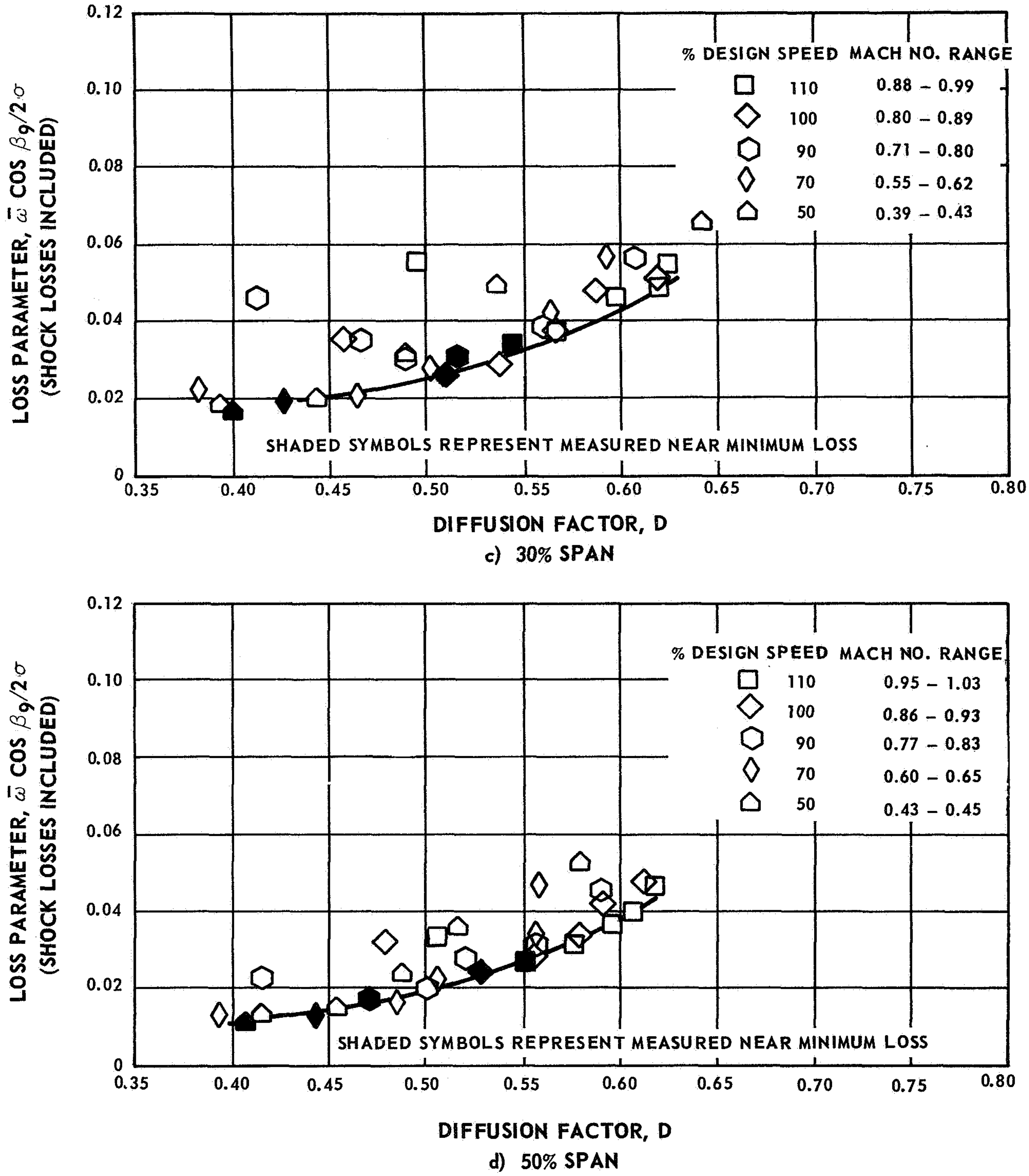
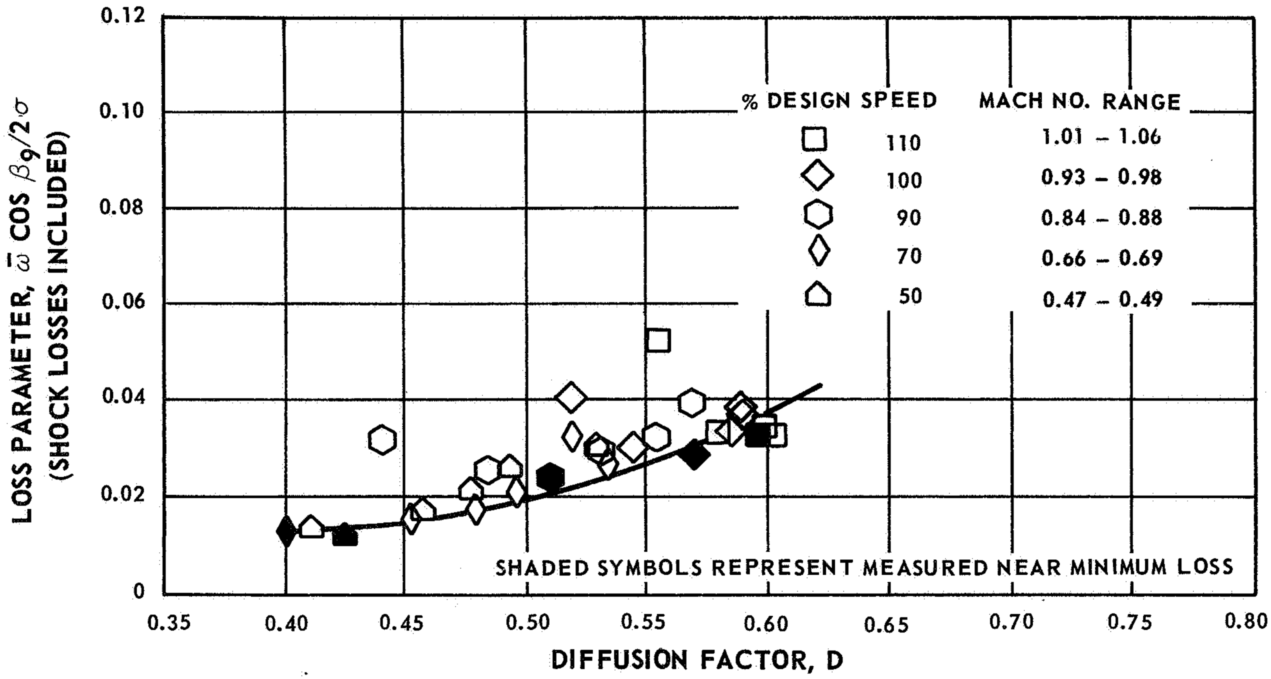
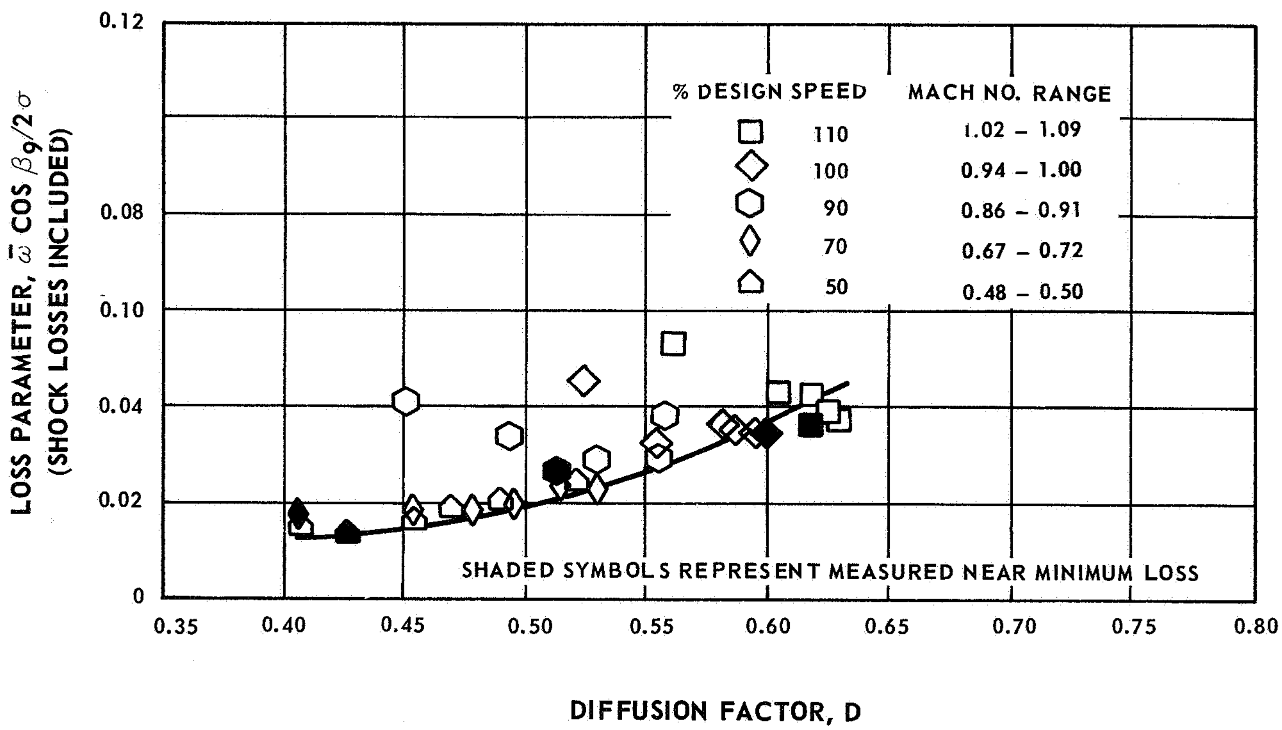


Figure 20 MCA Stator A (Slotted), Loss Parameter vs. Diffusion Factor

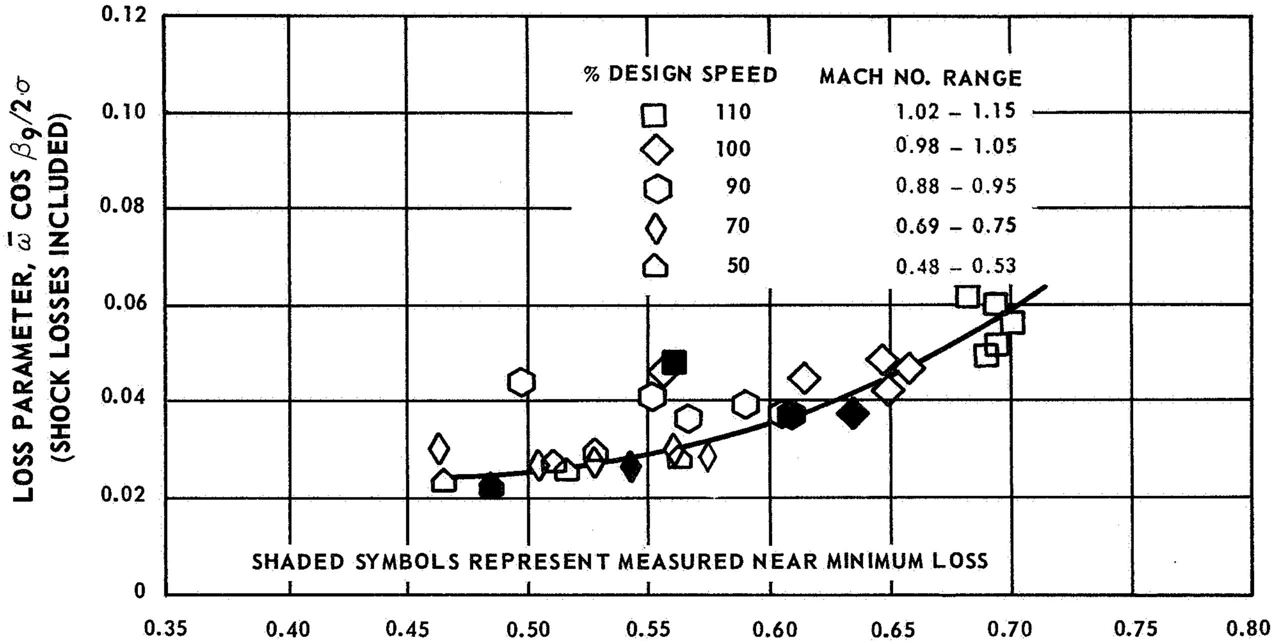


e) 70% SPAN

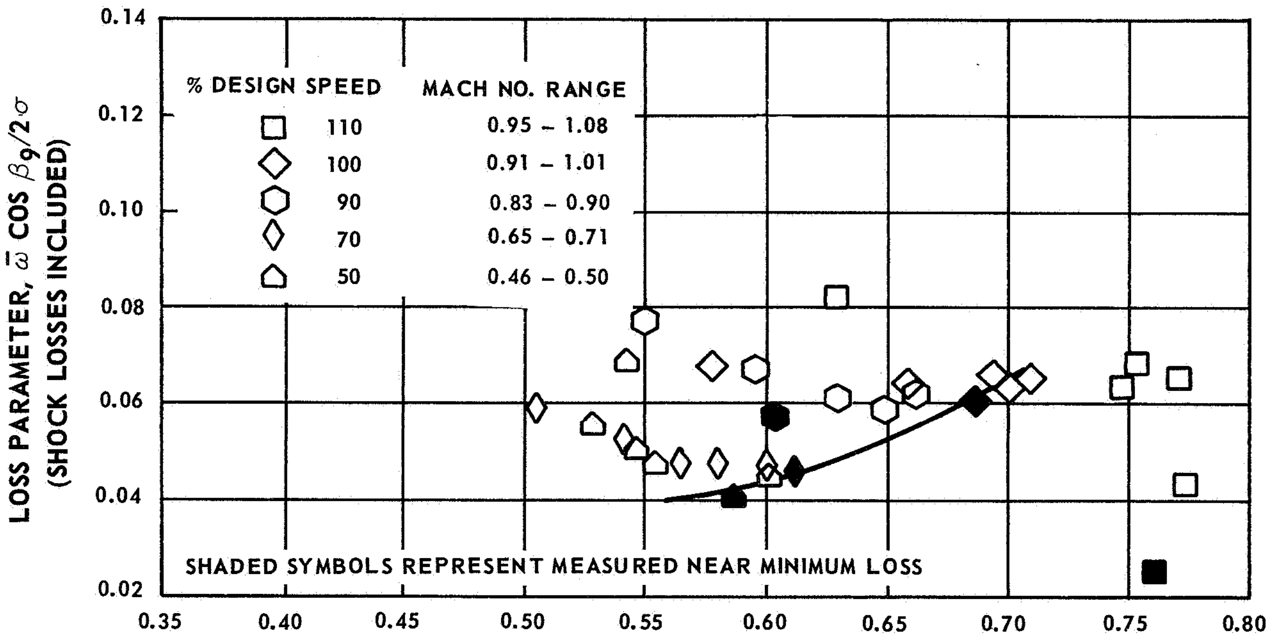


f) 80% SPAN

Figure 20 MCA Stator A (Slotted), Loss Parameter vs. Diffusion Factor



g) 90% SPAN



h) 95% SPAN

Figure 20 MCA Stator A (Slotted), Loss Parameter vs. Diffusion Factor

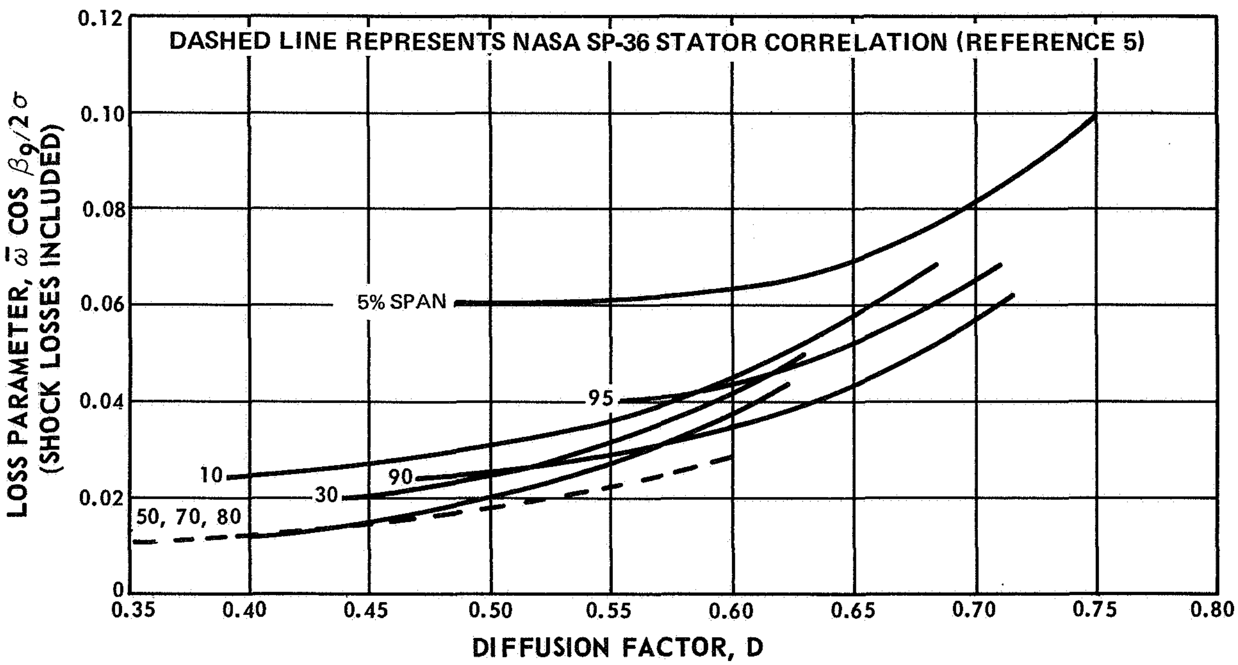


Figure 21 MCA Stator A (Slotted), Minimum Loss Parameter vs. Diffusion Factor

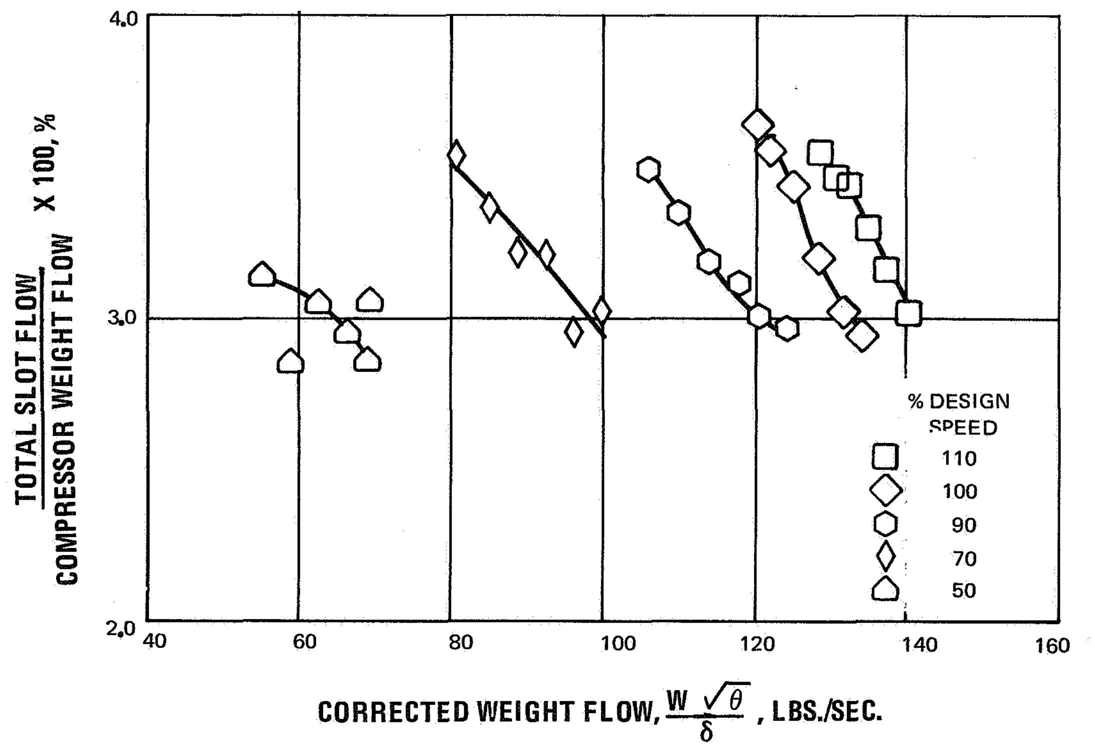


Figure 22 MCA Stator A (Slotted), Total Slot Flow as a Percent of Compressor Weight Flow vs. Corrected Weight Flow

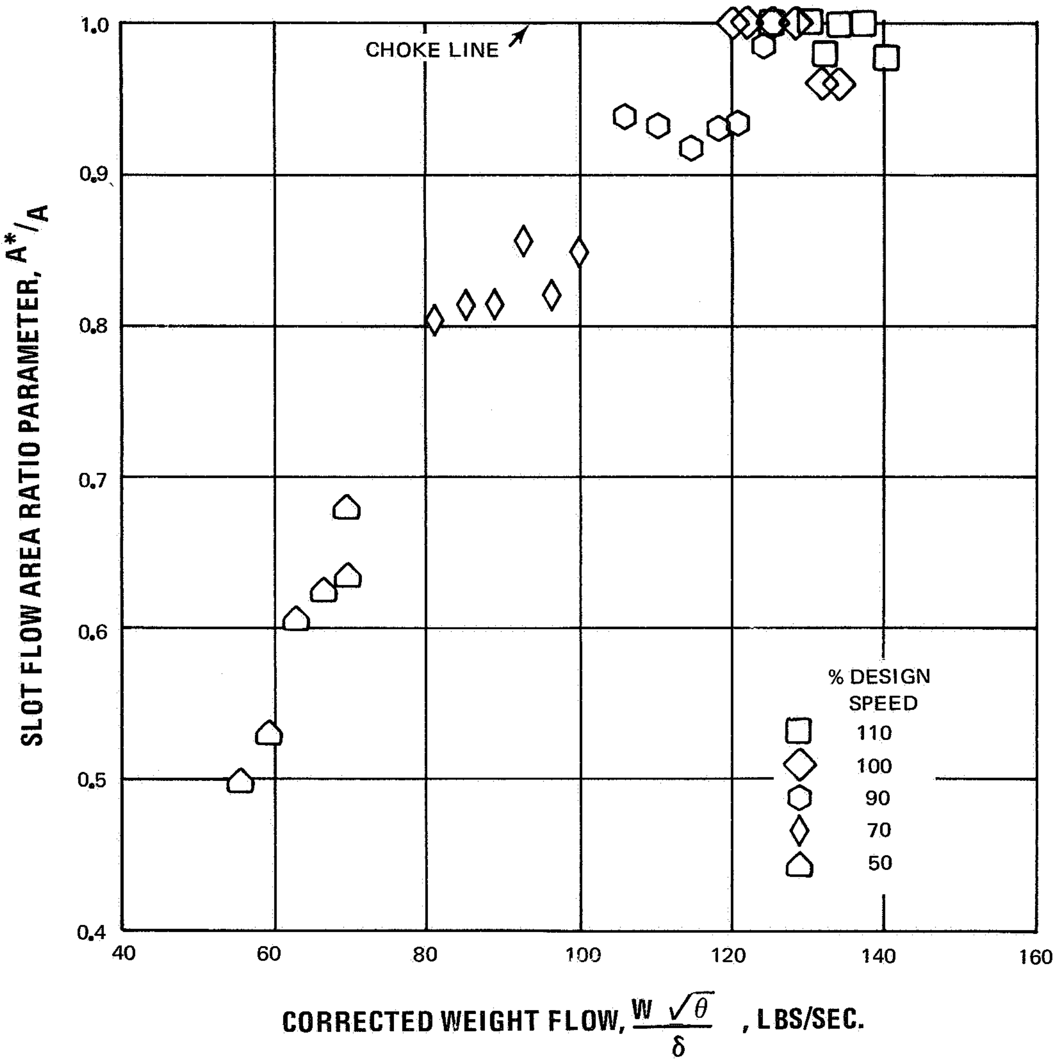


Figure 23 MCA Stator A (Slotted), Slot Choke Parameter (A*/A) vs. Corrected Weight Flow

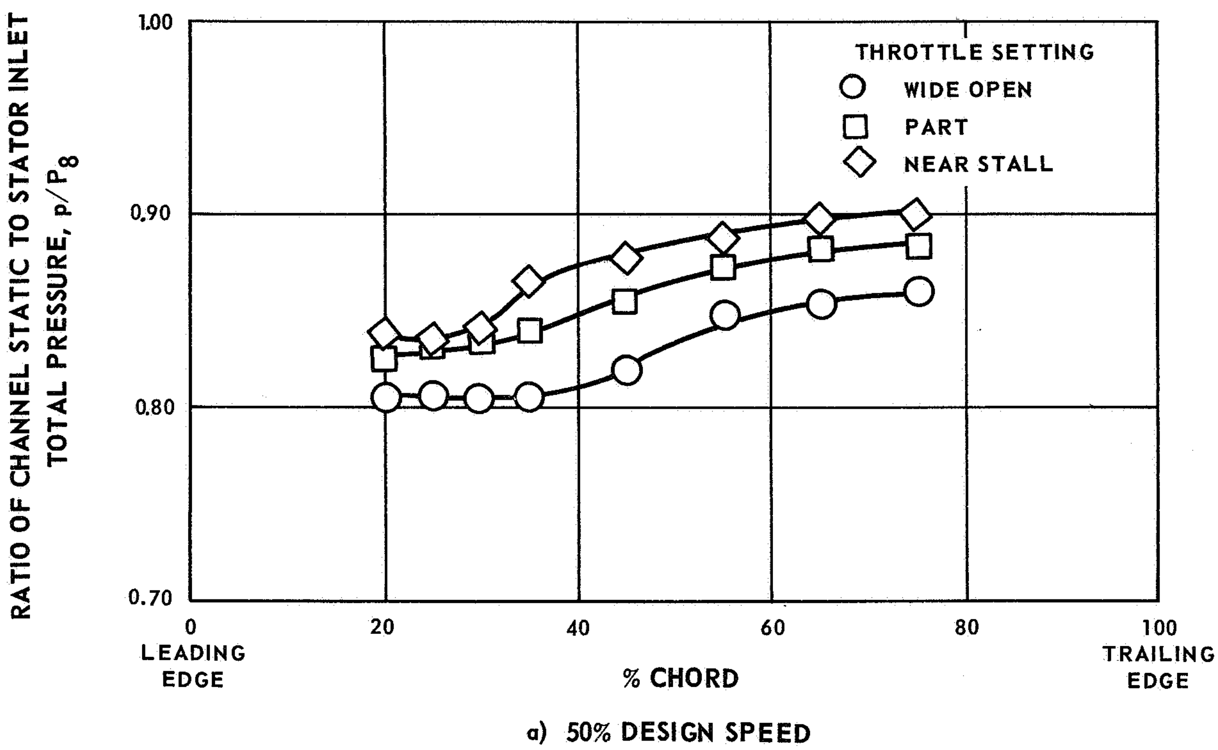
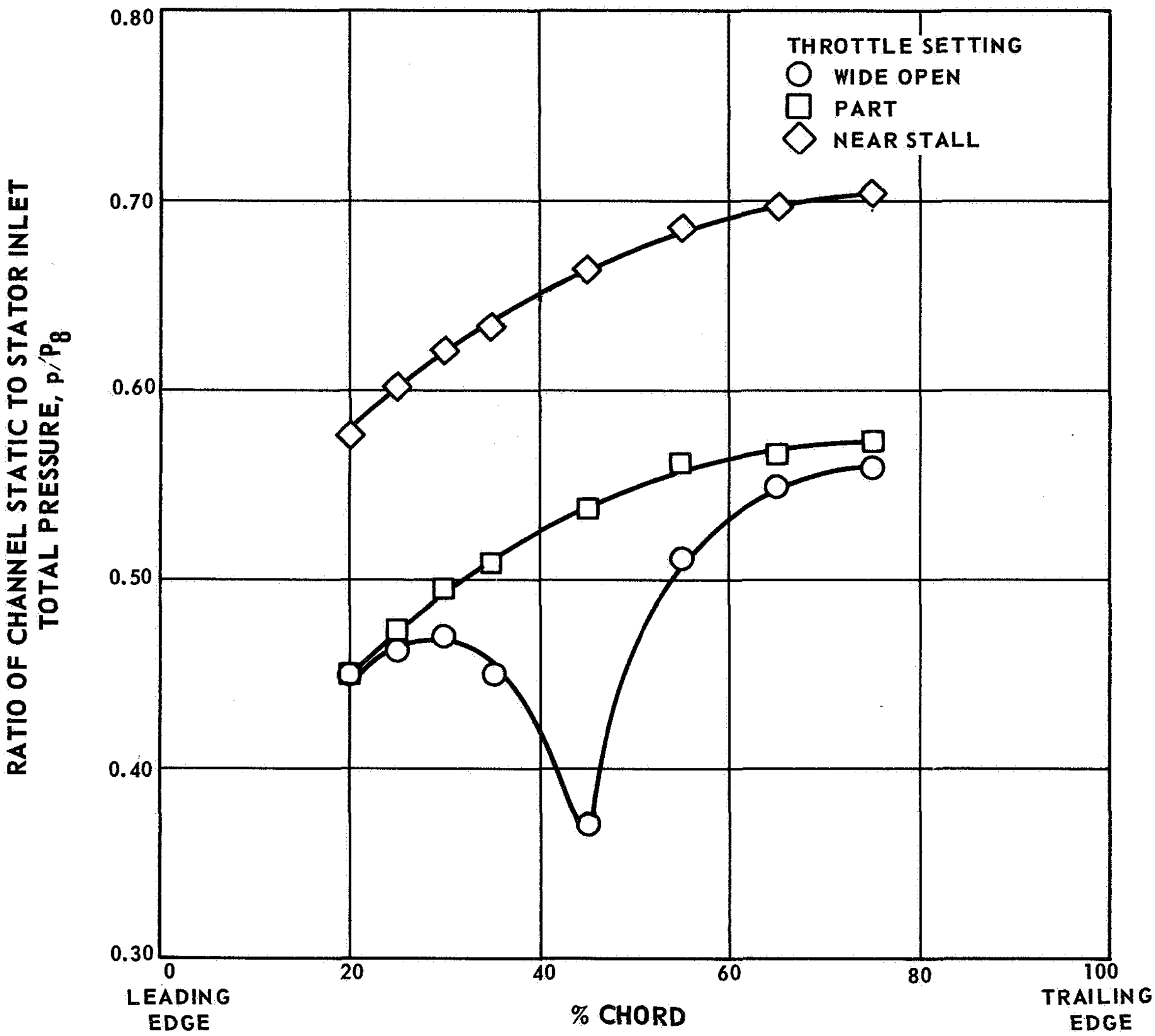
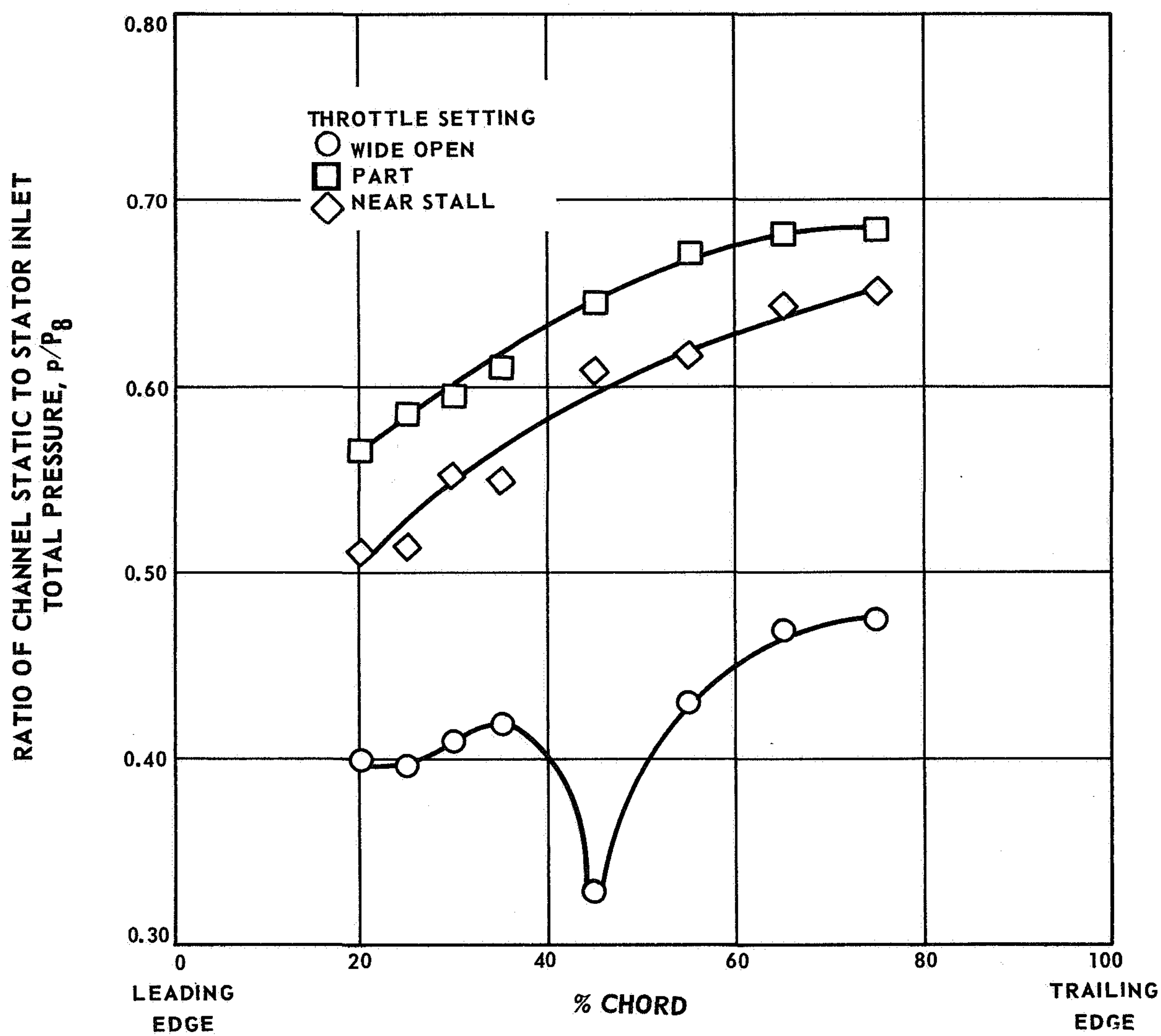


Figure 24 MCA Stator A (Slotted), Hub Mid-Channel Static Pressure Gradient



b) 100% DESIGN SPEED

Figure 24 MCA Stator A (Slotted), Hub Mid-Channel Static Pressure Gradient



c) 110% DESIGN SPEED

Figure 24 MCA Stator A (Slotted), Hub Mid-Channel Static Pressure Gradient

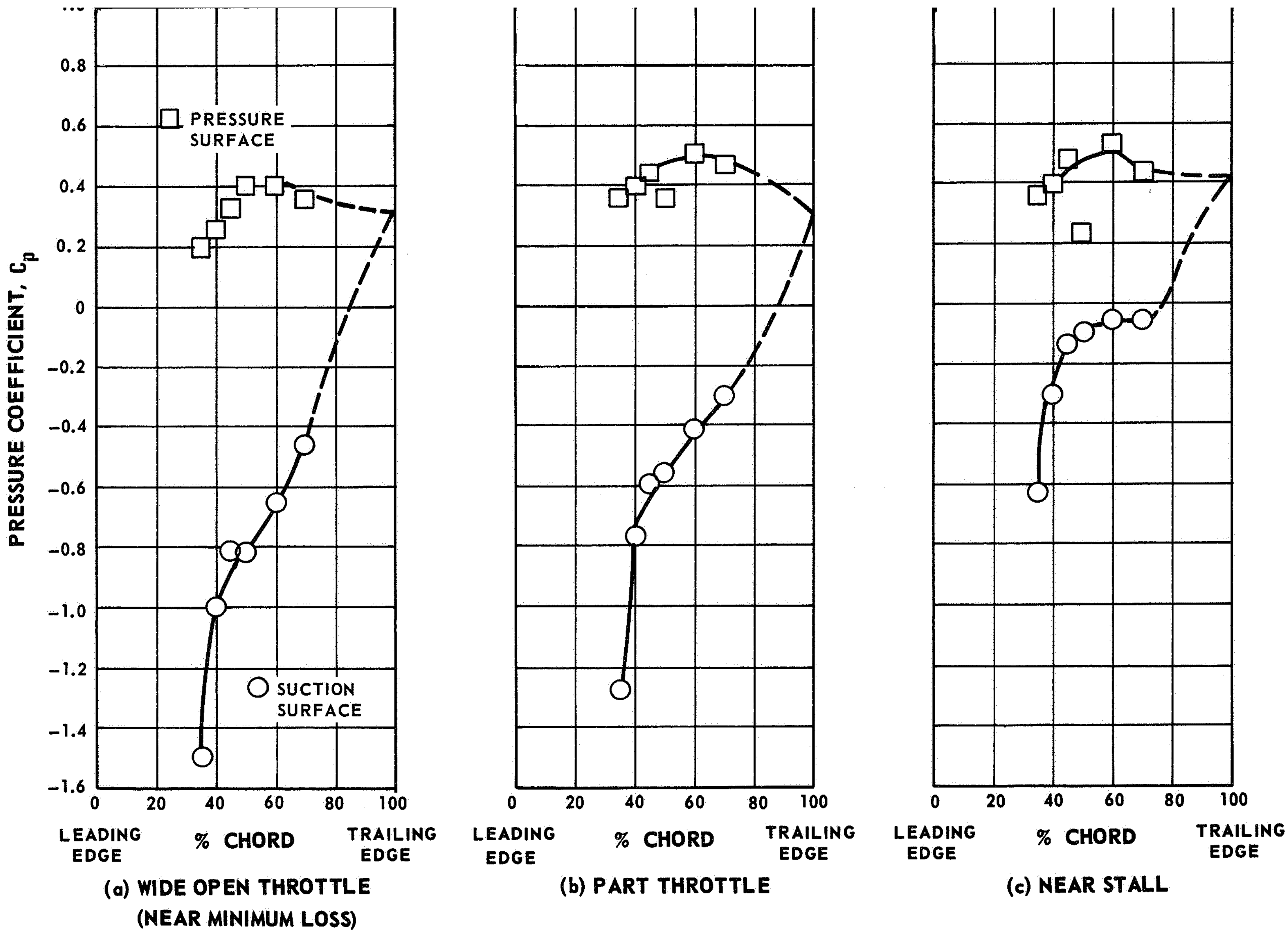


Figure 25 MCA Stator A (Slotted) Pressure Coefficient (C_p) vs. Percent Chord, 50% Design Speed, 10% Span

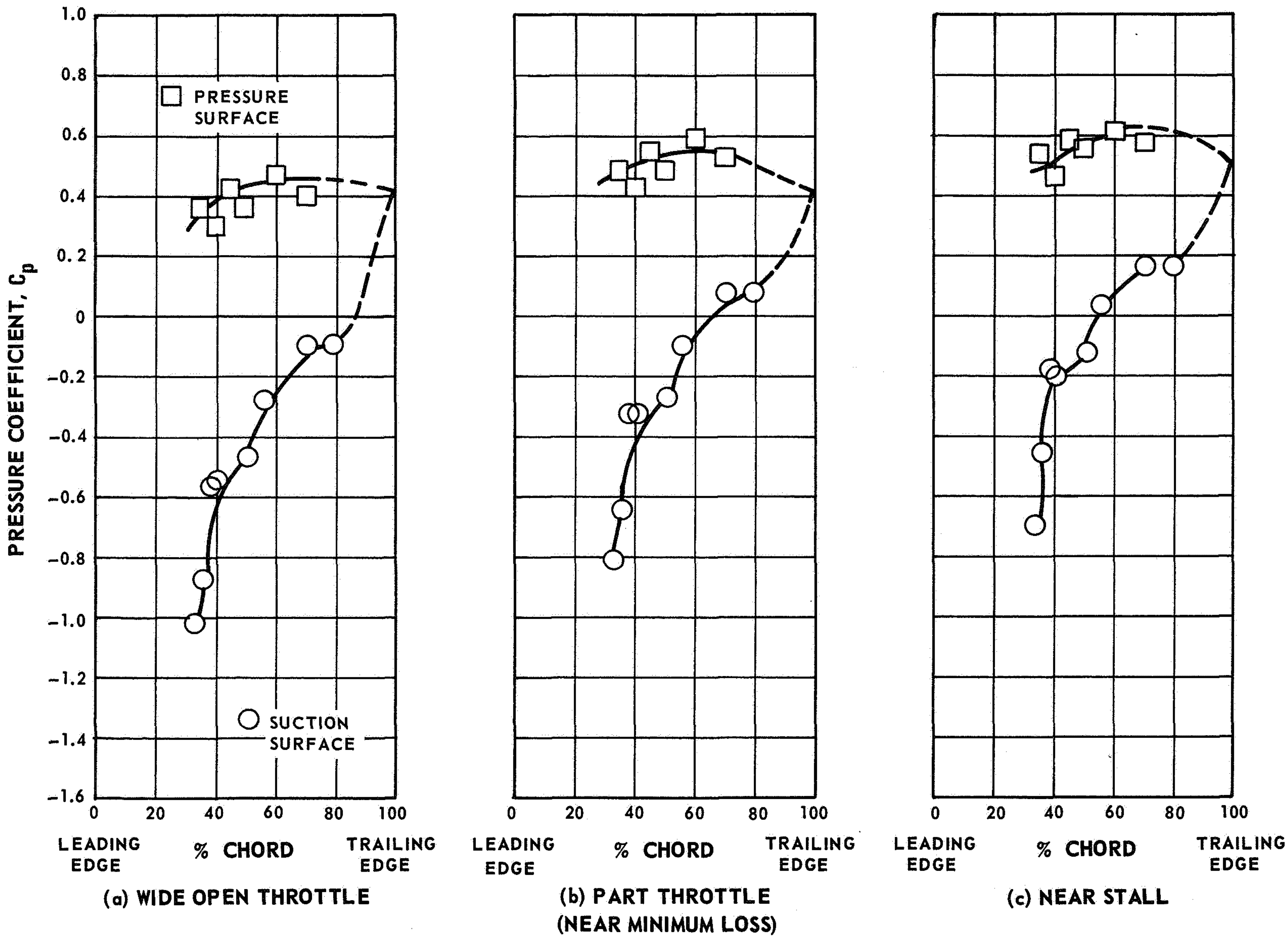


Figure 26 MCA Stator A (Slotted), Pressure Coefficient (C_p) vs. Percent Chord, 50% Design Speed, 90% Span

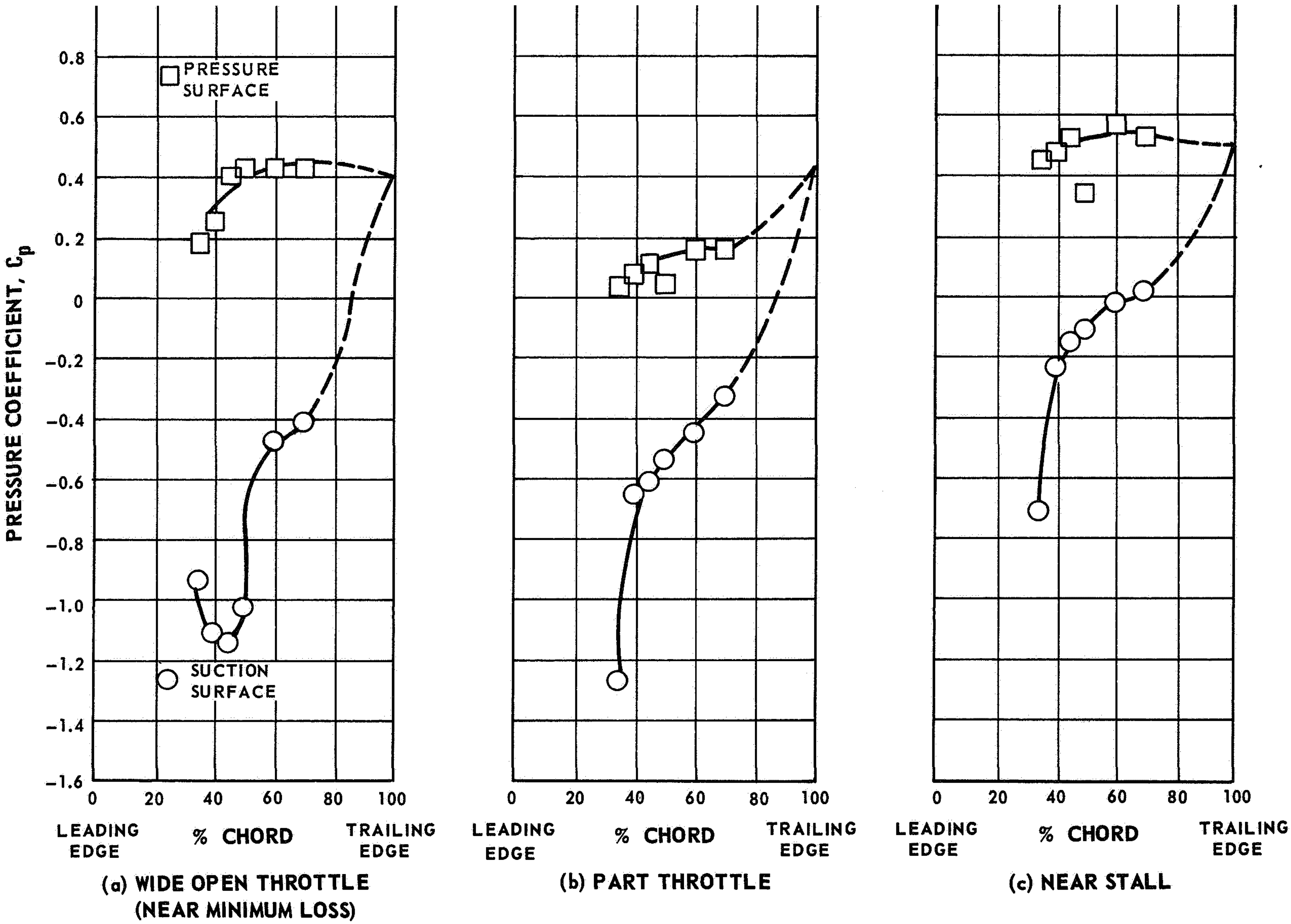


Figure 27 MCA Stator A (Slotted), Pressure Coefficient (C_p) vs. Percent Chord, 100% Design Speed, 10% Span

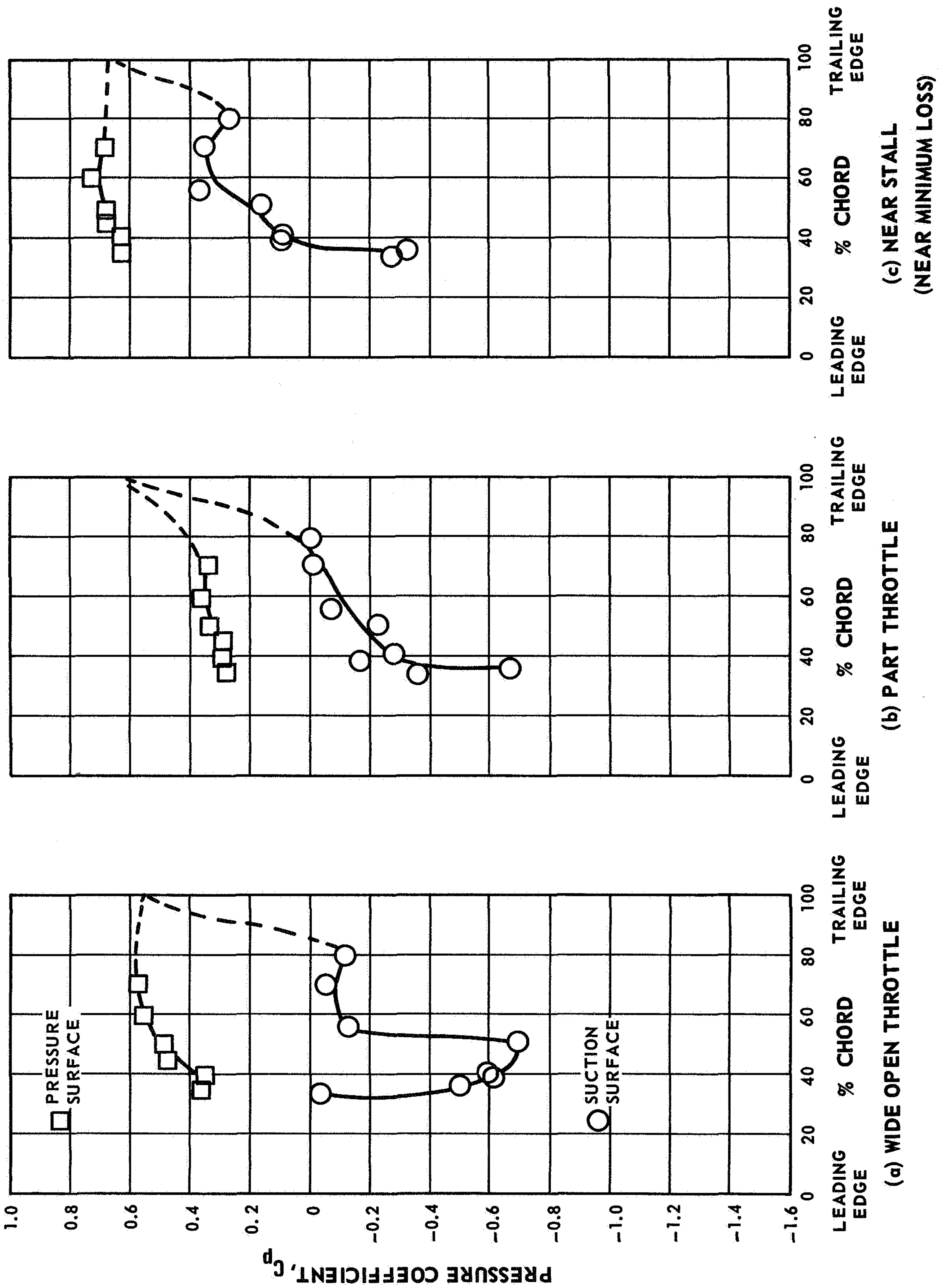


Figure 28 MCA Stator A (Slotted) Pressure Coefficient (C_p) vs. Percent Chord, 100% Design Speed, 90% Span

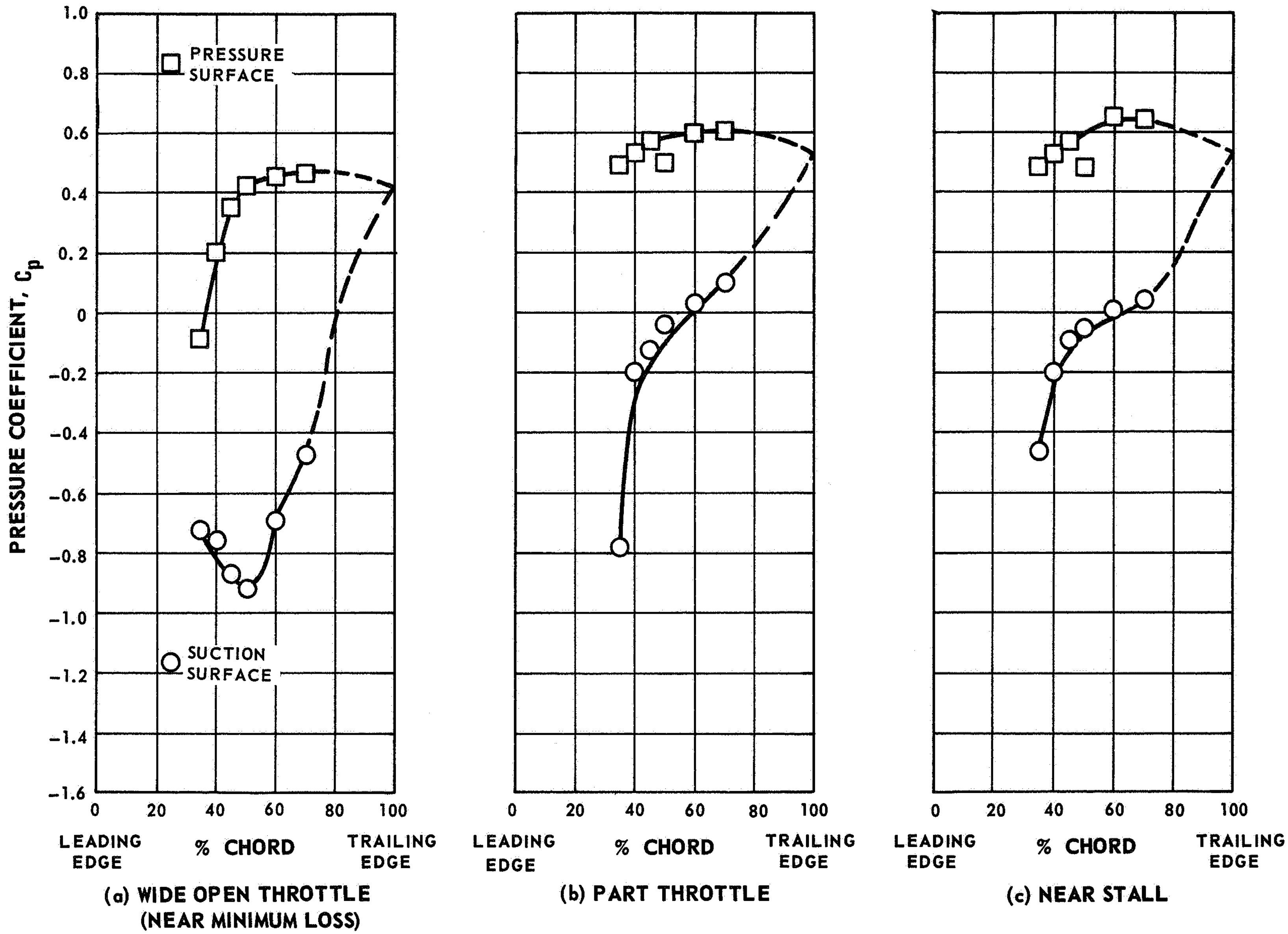


Figure 29 MCA Stator A (Slotted), Pressure Coefficient (C_p) vs. Percent Chord, 110% Design Speed, 10% Span

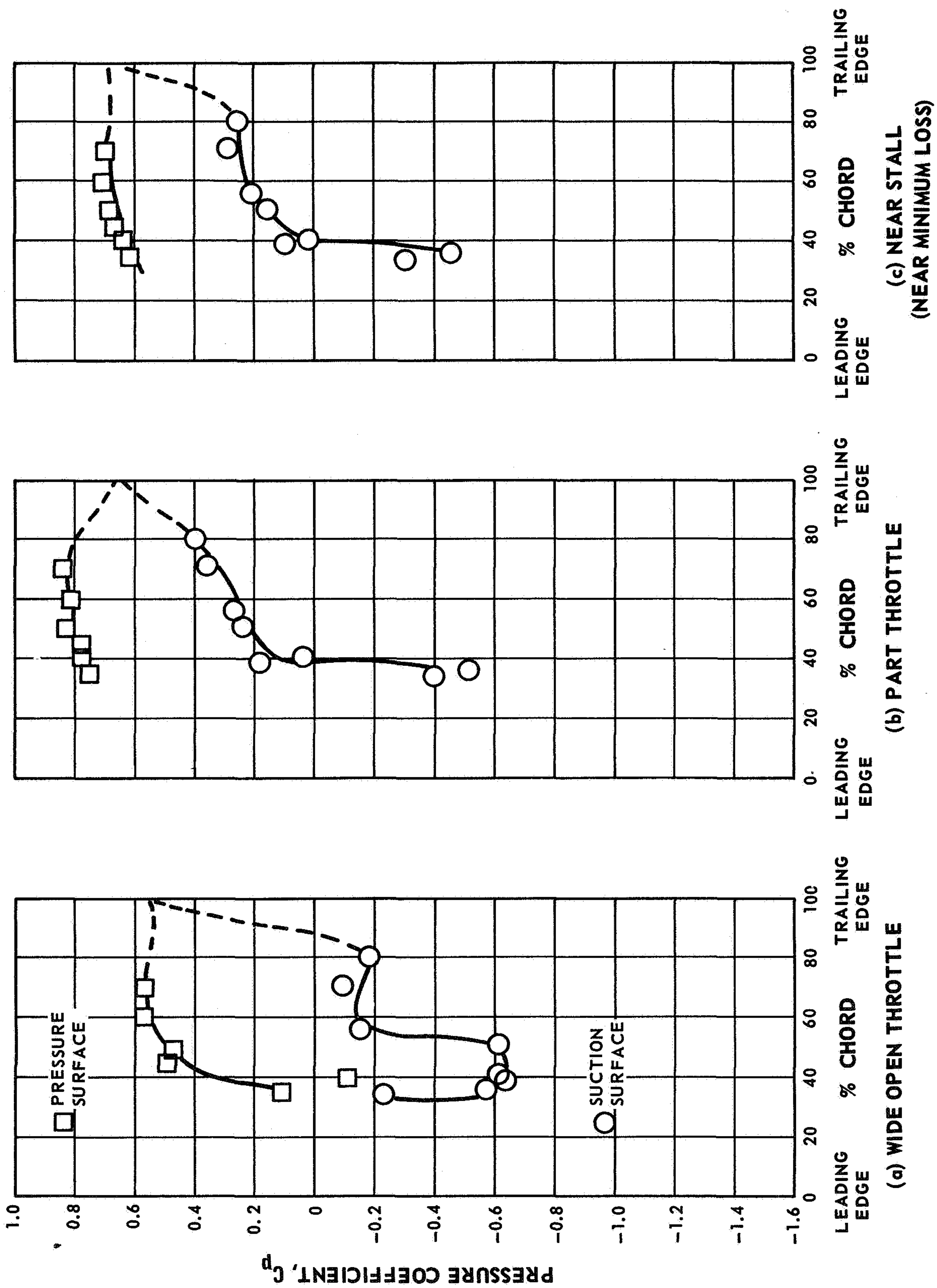


Figure 30 MCA Stator A (Slotted), Pressure Coefficient (C_p) vs. Percent Chord, 110% Design Speed, 90% Span

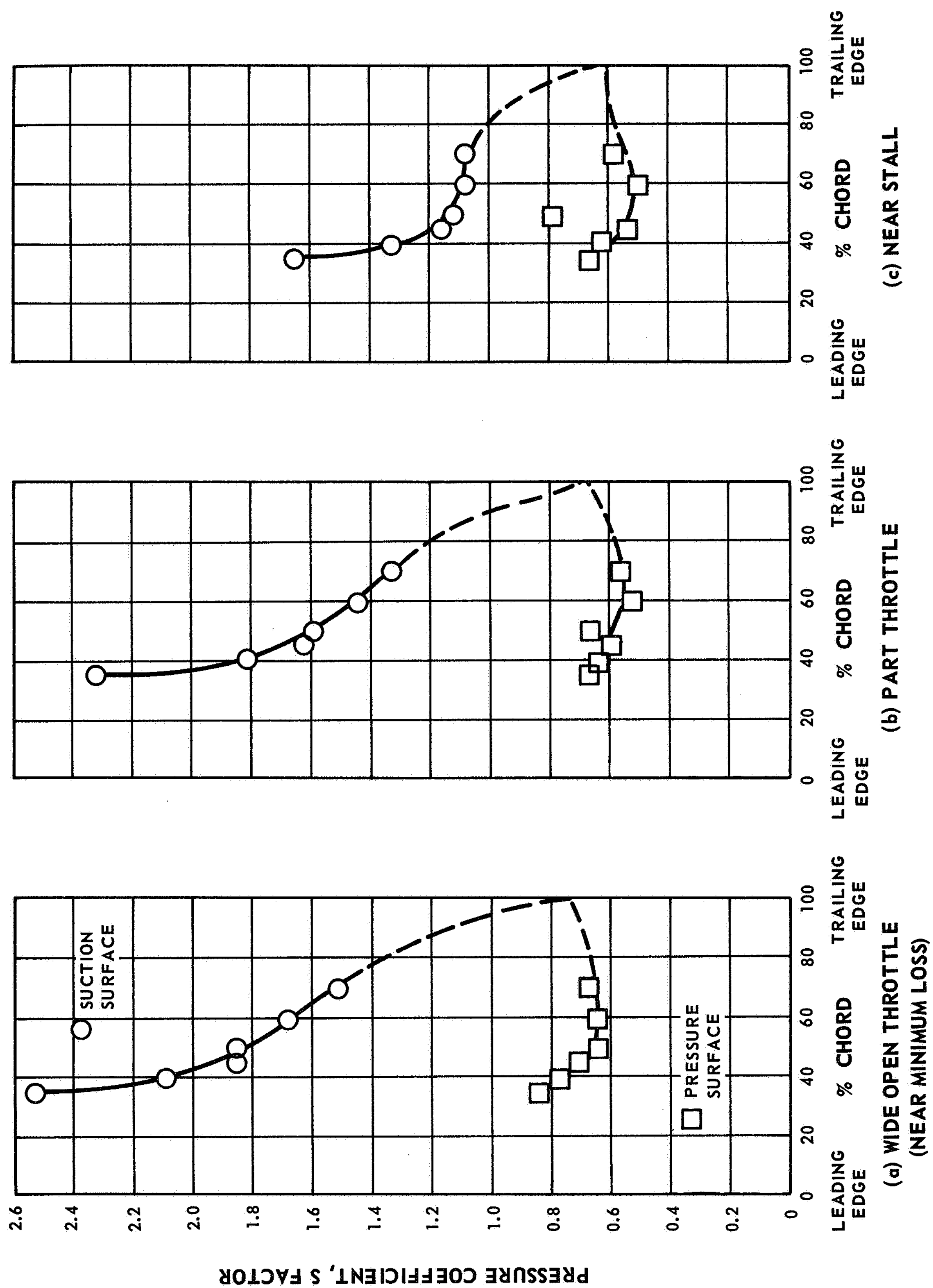


Figure 31 MCA Stator A (Slotted), Pressure Coefficient (S Factor) vs. Percent Chord, 50% Design Speed, 10% Span

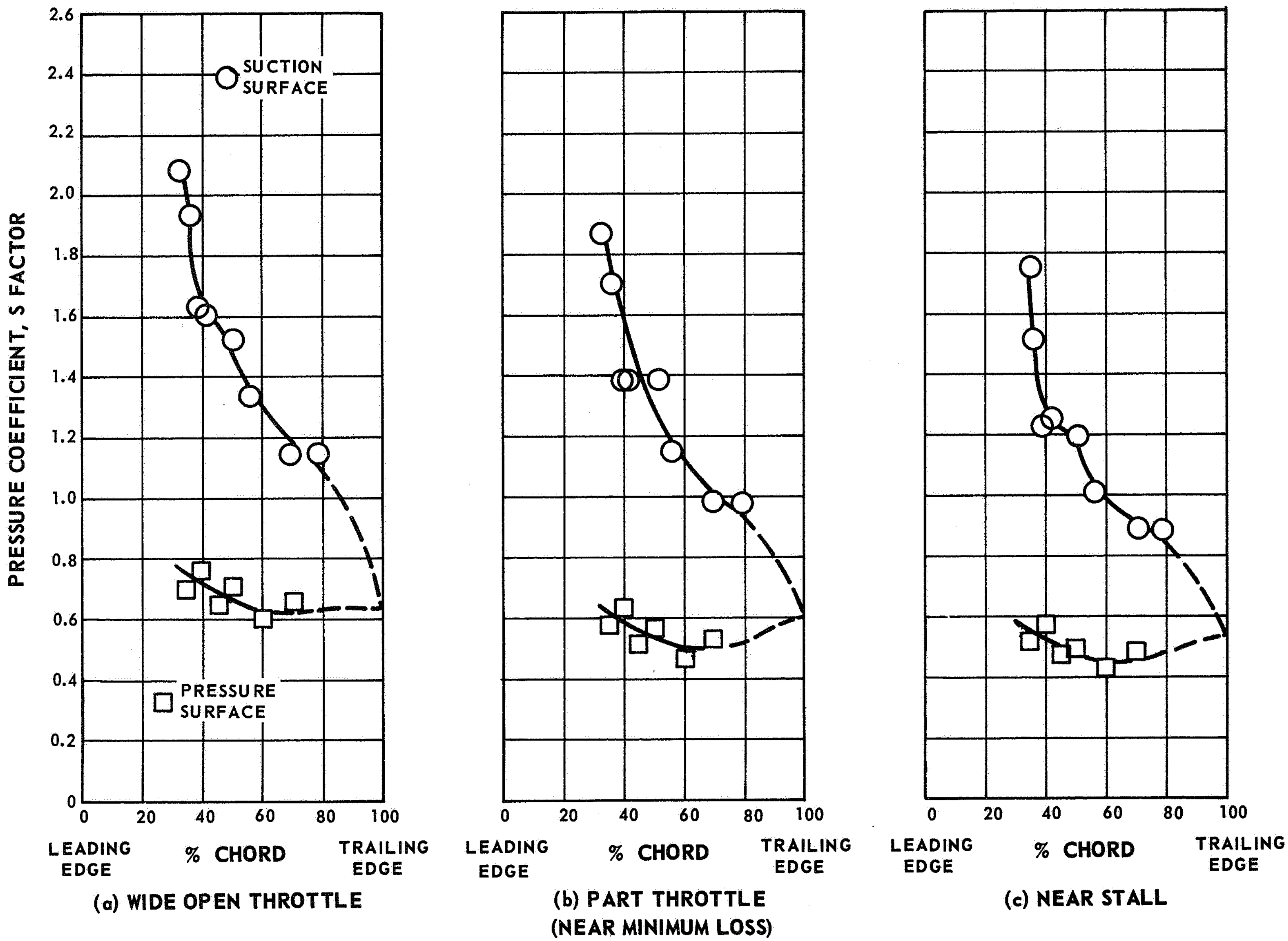


Figure 32 MCA Stator A (Slotted), Pressure Coefficient (S Factor) vs. Percent Chord, 50% Design Speed, 90% Span

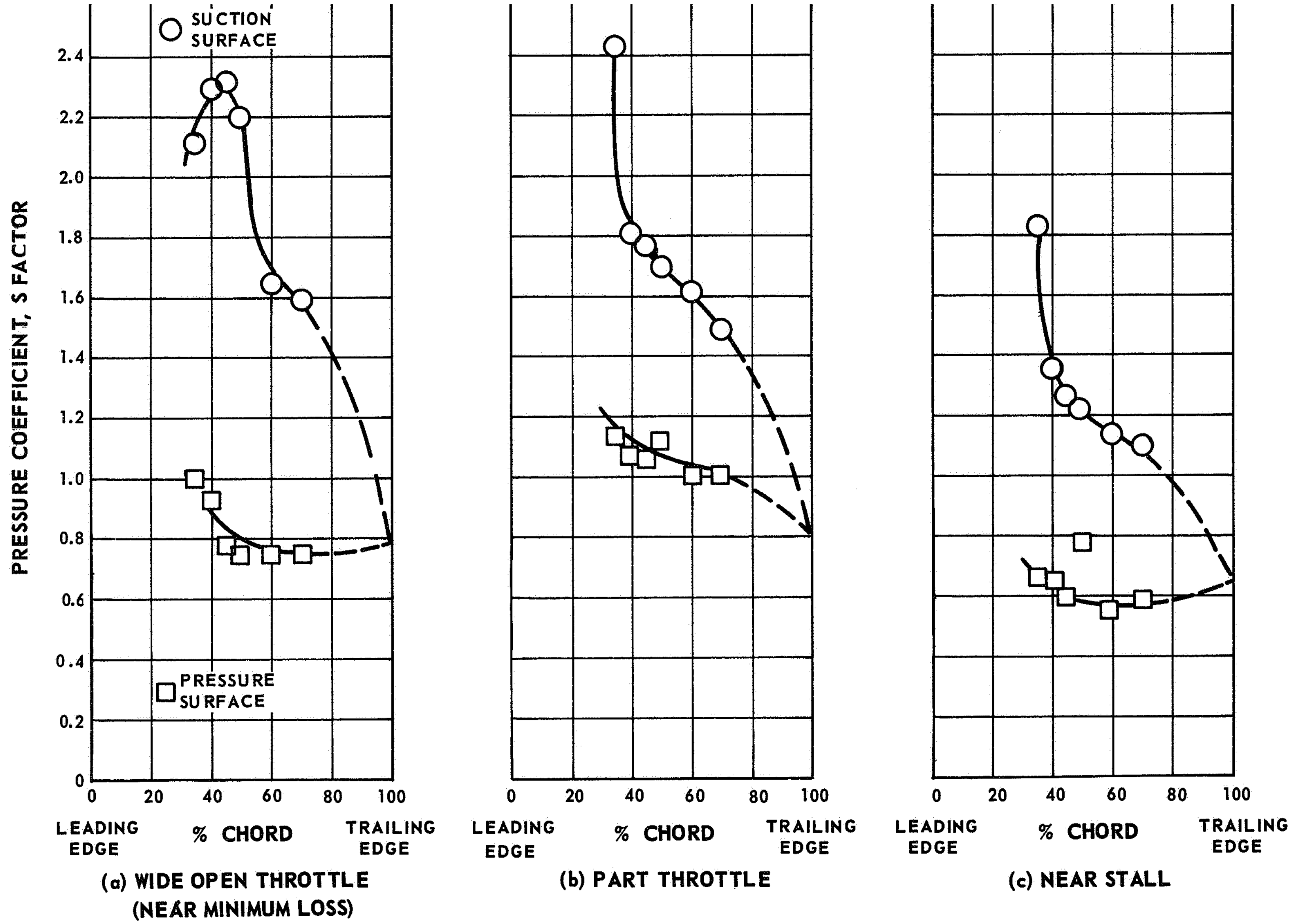


Figure 33 MCA Stator A (Slotted), Pressure Coefficient (S Factor) vs. Percent Chord, 100% Design Speed, 10% Span

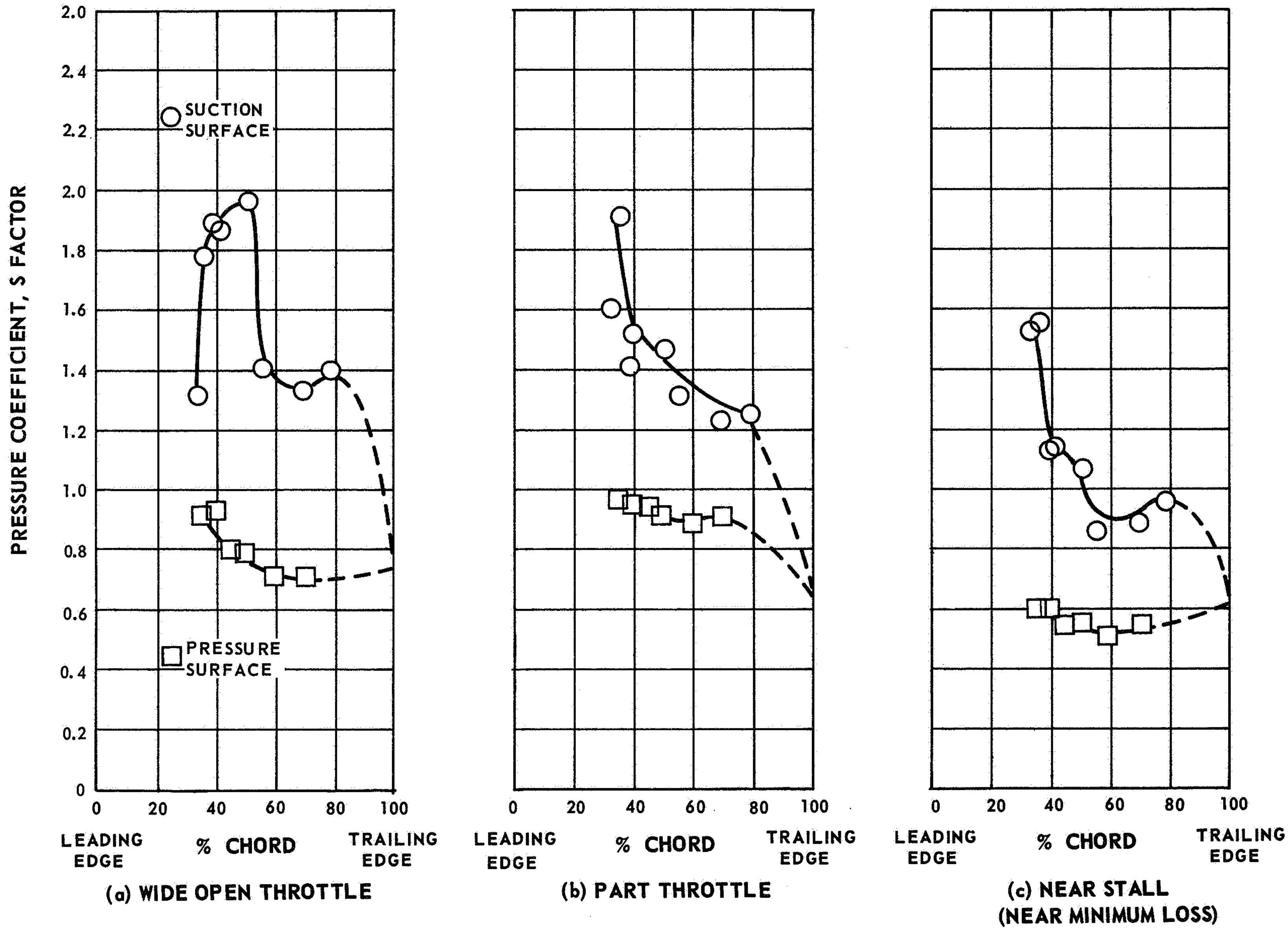


Figure 34 MCA Stator A (Slotted), Pressure Coefficient (S Factor) vs. Percent Chord, 100% Design Speed, 90% Span

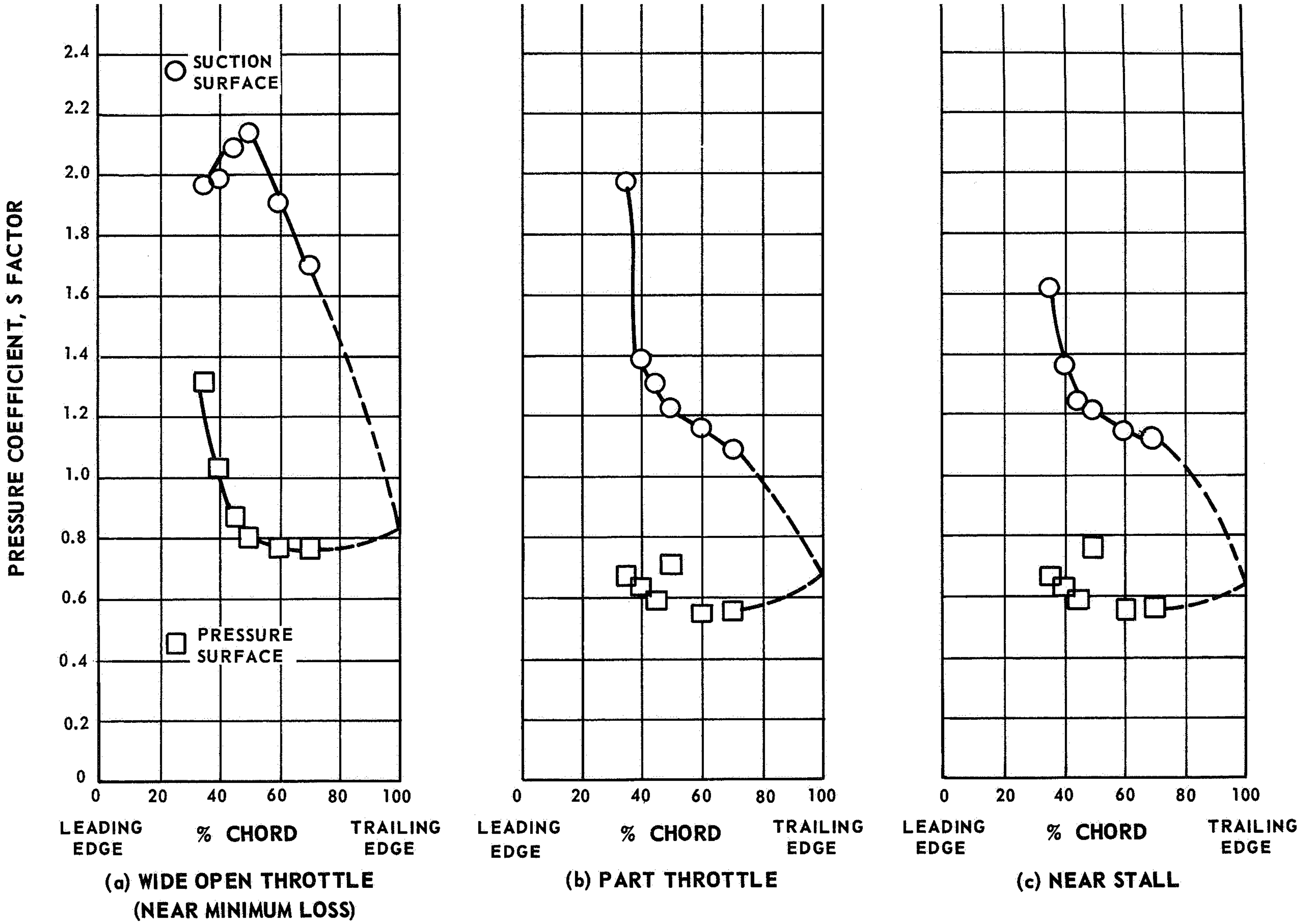


Figure 35 MCA Stator A (Slotted), Pressure Coefficient (S Factor) vs. Percent Chord, 110% Design Speed, 10% Span

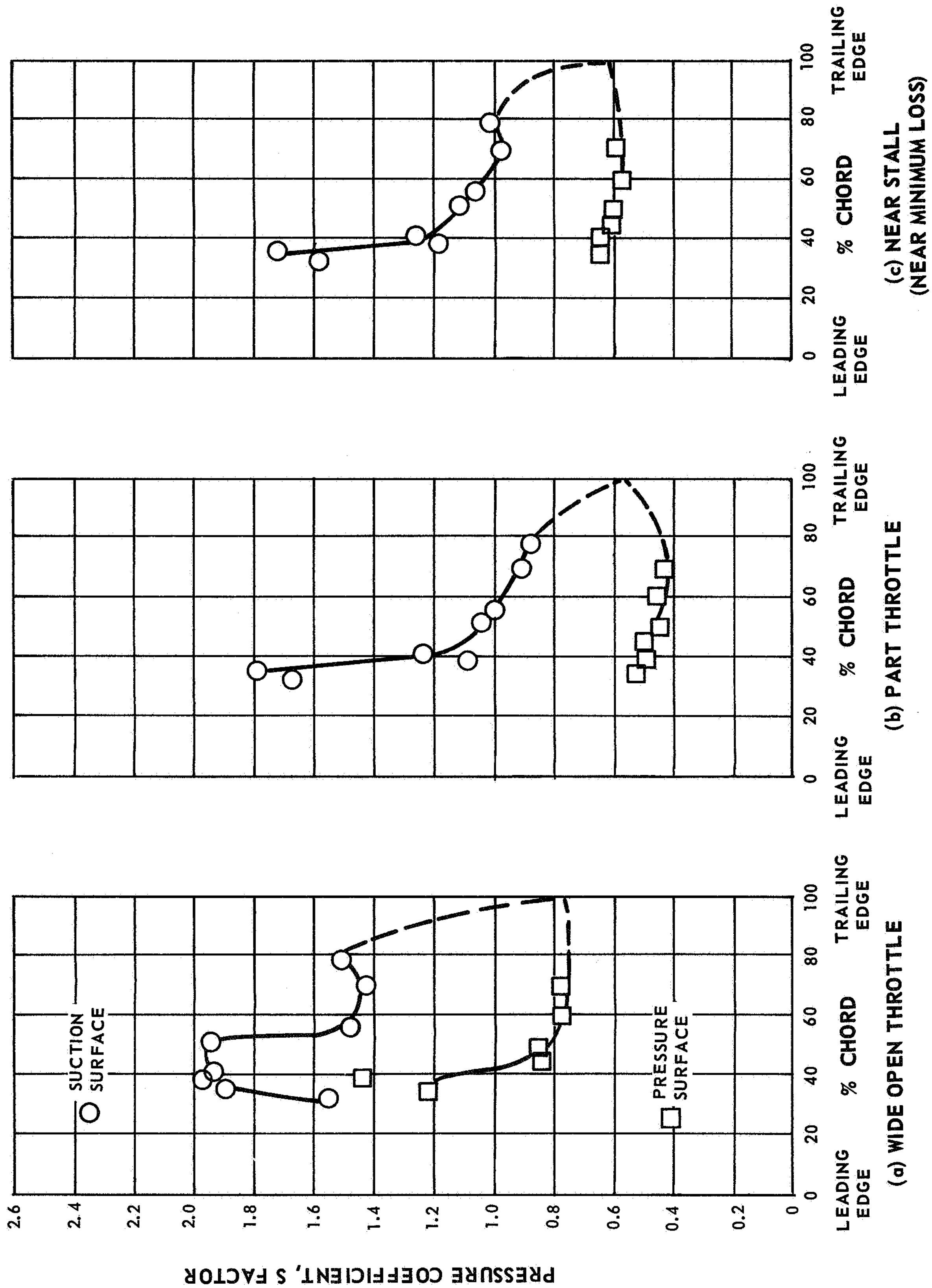


Figure 36 MCA Stator A (Slotted), Pressure Coefficient (S Factor) vs. Percent Chord, 110% Design Speed, 90% Span

APPENDIX A

Blade Element Data Tabulation

TABLE 1-1 BLADE ELEMENT PERFORMANCE AT 50% DESIGN SPEED, POINT 1, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	51.604	48.640	46.612	44.981	41.816	39.971	38.959	40.473
β_9	4.505	4.469	3.885	3.437	3.244	3.254	3.268	2.898
V_8	557.452	586.953	560.232	540.311	506.791	481.427	457.914	428.273
V_9	366.338	407.977	423.499	414.041	396.044	382.774	367.141	304.658
V_{Z8}	345.462	387.051	384.202	381.678	377.451	368.862	356.061	325.787
V_{Z9}	364.127	405.620	421.588	412.540	395.022	382.011	366.512	304.255
$V_{\theta 8}$	436.893	440.548	407.132	381.928	337.899	309.270	287.921	277.989
$V_{\theta 9}$	28.774	31.793	28.690	24.819	22.413	21.725	20.930	15.401
M_8	.501	.529	.504	.486	.455	.431	.410	.382
M_9	.325	.363	.377	.369	.353	.341	.326	.270
$\Delta\beta$	47.099	44.170	42.728	41.544	38.572	36.717	35.691	37.576
$\bar{\omega}$	.211	.088	.050	.040	.041	.051	.071	.176
$\bar{\omega}\ \cos\beta_9/2\sigma$	.055	.023	.014	.012	.013	.017	.025	.062
D	.528	.485	.427	.425	.415	.399	.401	.506
η_p	.656	.849	.903	.917	.905	.872	.815	.661
i_m	9.364	7.890	9.002	8.691	8.636	8.721	8.629	10.043
i_s	3.624	1.701	1.822	.901	-.714	-1.709	-2.701	-1.357
$\delta°$	14.275	13.939	12.695	12.217	11.744	11.854	12.508	12.428

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 49,9775

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 4433.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 69.380

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 13.2379

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 18.4521

TABLE 1-2 BLADE ELEMENT PERFORMANCE AT 50% DESIGN SPEED, POINT 2, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.689	23.670	24.480	26.350	28.190	30.000	30.540
β_8	49.960	47.101	45.656	44.720	41.925	39.790	39.807	41.393
β_9	3.612	3.716	3.319	2.812	2.513	2.492	2.493	2.456
V_8	548.933	578.452	556.605	538.057	496.670	479.064	455.275	425.493
V_9	352.071	412.074	430.445	420.260	393.422	385.082	369.812	291.335
V_{Z8}	352.423	393.013	388.458	381.856	369.304	368.030	349.737	319.197
V_{Z9}	350.396	410.150	428.832	419.039	392.688	384.585	369.435	291.057
$V_{\theta 8}$	420.263	423.747	398.058	378.598	331.857	306.592	291.468	281.345
$V_{\theta 9}$	22.183	26.704	24.922	20.619	17.247	16.740	16.084	12.486
M_8	.494	.522	.501	.484	.445	.429	.407	.380
M_9	.312	.367	.384	.374	.350	.343	.329	.258
$\Delta\beta$	46.348	43.385	42.337	41.907	39.413	37.299	37.314	38.937
$\bar{\omega}$	.268	.090	.060	.048	.036	.058	.065	.202
$\bar{\omega}\ \cos\beta_9/2\sigma$	.069	.024	.016	.014	.011	.019	.023	.072
D	.542	.465	.408	.411	.407	.393	.398	.539
η_p	.577	.834	.865	.887	.913	.844	.821	.637
i_m	7.720	6.351	8.046	8.430	8.745	8.540	9.477	10.963
i_s	1.980	0.160	.866	.640	-.605	-1.890	-1.853	-.437
$\delta°$	13.382	13.186	12.129	11.592	11.013	11.092	11.733	11.986

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 49,9684

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 4432.200

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 69.400

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 13.2417

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 18.4574

TABLE 1-3 BLADE ELEMENT PERFORMANCE AT 50% DESIGN SPEED, POINT 3, MCA STATOR A (SLOTTED)

	STATOR							
% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	51.051	48.178	47.264	46.632	43.207	42.071	43.091	45.494
β_9	4.063	4.241	3.472	3.173	2.561	2.644	2.645	2.568
V_8	543.942	571.418	551.297	534.533	487.765	467.196	441.226	407.889
V_9	346.704	382.571	403.147	396.207	366.283	356.751	335.890	278.444
V_{Z8}	341.305	380.378	373.621	366.673	355.353	346.760	322.214	285.923
V_{Z9}	344.955	380.631	401.660	395.007	365.638	356.272	335.513	278.156
$V_{\theta 8}$	423.025	425.833	404.920	388.582	333.942	313.042	301.425	290.897
$V_{\theta 9}$	24.565	28.290	24.418	21.927	16.367	16.454	15.497	12.475
M_8	.489	.515	.496	.480	.437	.418	.393	.363
M_9	.307	.340	.358	.352	.325	.317	.298	.246
$\Delta\beta$	46.988	43.937	43.791	43.459	40.646	39.427	40.446	42.926
$\bar{\omega}$	.197	.101	.063	.057	.049	.060	.070	.197
$\bar{\omega}\cos\beta_9/2\sigma$	.051	.027	.017	.017	.015	.020	.024	.070
D	.548	.511	.455	.457	.454	.443	.464	.559
η_p	.692	.833	.875	.885	.898	.861	.843	.647
i_m	8.811	7.428	9.654	10.342	10.027	10.821	12.761	15.064
i_s	3.071	0.220	2.474	2.552	.677	.391	1.431	3.664
$\delta°$	13.833	13.711	12.282	11.953	11.061	11.244	11.885	12.098

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 50.0552

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 4439.900

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 66.220

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 12.6350

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 17.6117

TABLE 1-4 BLADE ELEMENT PERFORMANCE AT 50% DESIGN SPEED, POINT 4, MCA STATOR A (SLOTTED)

	STATOR							
% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	50.246	47.946	48.214	48.488	45.347	44.952	48.801	51.789
β_9	5.288	5.461	5.110	4.782	3.813	3.815	3.823	3.817
V_8	540.349	562.854	545.453	534.048	483.185	458.504	425.756	393.289
V_9	338.050	371.173	390.296	385.648	349.015	332.553	300.819	250.482
V_{Z8}	345.047	376.521	363.099	353.690	339.483	324.459	280.434	243.275
V_{Z9}	335.922	368.799	388.186	383.871	348.056	331.755	300.140	249.923
$V_{\theta 8}$	415.420	417.924	406.713	399.905	343.729	323.940	320.350	309.020
$V_{\theta 9}$	31.154	35.321	34.763	32.147	23.210	22.124	20.056	16.673
M_8	.485	.507	.490	.479	.432	.409	.378	.349
M_9	.299	.329	.346	.342	.309	.294	.265	.221
$\Delta\beta$	44.958	42.485	43.104	43.707	41.634	41.137	44.978	47.972
$\bar{\omega}$	.184	.100	.069	.075	.075	.093	.109	.211
$\bar{\omega}\cos\beta_9/2\sigma$	.047	.026	.019	.022	.024	.030	.038	.075
D	.555	.516	.469	.477	.487	.489	.539	.626
η_p	.720	.836	.866	.856	.856	.812	.793	.659
i_m	8.006	7.196	10.604	12.198	12.167	13.702	18.471	21.359
i_s	2.266	1.004	3.424	4.408	2.817	3.272	7.141	9.959
$\delta°$	15.058	14.931	13.920	13.562	12.313	12.415	13.063	13.347

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 50.0259

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 4437.300

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 62.660

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 11.9557

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 16.6649

TABLE 1-5 BLADE ELEMENT PERFORMANCE AT 50% DESIGN SPEED, POINT 5, MCA STATOR A (SLOTTED)

STATOR								
% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	61.211	50.114	49.062	48.978	46.338	47.071	52.645	56.708
β_9	5.958	6.108	5.841	5.674	4.463	4.951	4.652	2.363
V_8	514.593	538.529	536.779	527.588	479.241	448.787	419.200	384.962
V_9	318.638	351.778	373.004	371.564	332.920	306.639	276.766	231.887
V_{Z8}	247.569	344.997	351.433	346.060	330.781	305.645	254.351	211.308
V_{Z9}	316.280	349.134	370.527	369.315	331.727	305.439	275.845	231.687
$V_{\theta 8}$	450.987	413.227	405.495	398.044	346.694	328.601	333.218	321.784
$V_{\theta 9}$	33.074	37.431	37.961	36.737	25.908	26.463	22.445	9.561
M_8	.461	.483	.481	.472	.428	.400	.372	.341
M_9	.282	.312	.330	.329	.295	.271	.244	.204
$\Delta\beta$	55.253	44.006	43.221	43.304	41.875	42.120	47.993	54.345
$\bar{\omega}$	.161	.109	.078	.089	.114	.149	.174	.261
$\bar{\omega}\cos\beta_9/2\sigma$	.041	.029	.021	.026	.036	.049	.060	.092
D	.587	.527	.490	.494	.516	.536	.597	.685
η_p	.757	.818	.853	.835	.796	.733	.707	.604
i_m	18.971	9.364	11.452	12.688	13.158	15.821	22.315	26.278
i_s	13.231	3.164	4.272	4.898	3.808	5.391	10.985	14.878
$\delta°$	15.728	15.578	14.651	14.454	12.963	13.551	13.892	11.893

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 50.0406

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 4438.600

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 59.130

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 11.2822

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 15.7261

TABLE 1-6 BLADE ELEMENT PERFORMANCE AT 50% DESIGN SPEED, POINT 6, MCA STATOR A (SLOTTED)

STATOR								
% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	53.483	50.959	50.822	50.666	49.052	52.803	58.432	65.732
β_9	3.043	3.145	3.411	3.542	2.887	2.988	2.553	.955
V_8	532.207	551.522	537.287	528.441	481.810	436.087	420.459	380.351
V_9	316.766	347.443	364.339	360.975	312.619	264.660	246.149	205.032
V_{Z8}	316.327	347.037	339.199	334.803	315.735	263.637	220.111	156.326
V_{Z9}	315.835	346.451	363.348	360.038	312.145	264.285	245.903	205.003
$V_{\theta 8}$	427.725	428.367	416.497	408.733	363.915	347.372	358.241	346.740
$V_{\theta 9}$	16.813	19.062	21.677	22.299	15.745	13.797	10.963	3.416
M_8	.477	.495	.481	.473	.430	.387	.372	.336
M_9	.280	.307	.322	.319	.276	.233	.216	.179
$\Delta\beta$	50.440	47.814	47.411	47.125	46.165	49.815	55.880	64.777
$\bar{\omega}$	.173	.108	.092	.107	.166	.202	.244	.240
$\bar{\omega}\cos\beta_9/2\sigma$	.045	.028	.025	.031	.053	.066	.085	.099
D	.601	.562	.521	.528	.579	.642	.702	.751
η_p	.751	.834	.840	.815	.730	.700	.653	.618
i_m	11.243	10.209	13.212	14.376	15.872	21.553	28.102	35.302
i_s	5.503	4.009	6.032	6.586	6.522	11.123	16.772	23.902
$\delta°$	12.813	12.615	12.221	12.322	11.367	11.588	11.793	10.435

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 50.0451

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 4439.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 55.140

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 10.5209

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 14.6649

TABLE 2-1 BLADE ELEMENT PERFORMANCE AT 70% DESIGN SPEED, POINT 1, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	48.526	46.006	44.253	42.677	39.773	38.339	37.479	38.043
β_9	8.625	8.622	6.785	6.010	4.805	4.888	4.876	3.454
V_8	785.548	826.331	790.163	765.752	722.473	692.436	658.101	629.778
V_9	518.264	573.743	597.439	589.521	568.051	551.415	536.390	445.659
V_{Z8}	519.071	572.735	564.986	562.177	554.878	542.974	522.239	495.975
V_{Z9}	510.999	565.673	591.904	585.177	565.476	549.188	534.400	444.829
$V_{\theta 8}$	588.573	594.468	551.395	519.078	462.198	429.523	400.433	388.102
$V_{\theta 9}$	76.824	86.010	70.585	61.721	47.581	46.986	45.596	26.849
M_8	.712	.753	.717	.694	.652	.623	.590	.563
M_9	.457	.508	.531	.524	.504	.489	.475	.392
$\Delta\beta$	40.001	37.384	37.468	36.668	34.968	33.450	32.602	34.589
$\bar{\omega}$	.232	.114	.063	.045	.042	.068	.066	.209
$\bar{\omega}\cos\beta_9/2\sigma$	.059	.030	.017	.013	.013	.022	.023	.074
D	.505	.464	.408	.403	.394	.383	.372	.495
η_p	.647	.821	.884	.912	.906	.840	.829	.621
i_m	6.286	5.256	6.643	6.387	6.593	7.089	7.149	7.613
i_s	.546	-0.944	-.537	-1.403	-2.757	-3.341	-4.181	-3.787
$\delta°$	18.295	18.092	15.595	14.790	13.305	13.488	14.116	12.984

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 69.8985

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 6200.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 99.900

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 19.0612

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 26.5691

TABLE 2-2 BLADE ELEMENT PERFORMANCE AT 70% DESIGN SPEED, POINT 2, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	50.171	47.471	46.071	44.827	42.098	40.518	40.021	40.544
β_9	6.726	6.923	5.996	5.022	4.295	4.273	4.254	3.731
V_8	773.536	813.266	780.780	757.921	703.042	676.229	644.461	617.771
V_9	489.399	538.926	562.774	555.114	527.040	517.670	499.309	415.355
V_{Z8}	494.354	548.607	540.777	536.818	521.290	513.944	493.519	469.445
V_{Z9}	484.602	533.533	558.451	551.970	525.038	516.030	497.890	414.456
$V_{\theta 8}$	594.048	599.323	562.316	534.314	471.323	439.335	414.433	401.568
$V_{\theta 9}$	57.323	64.962	58.788	48.596	39.474	38.568	37.034	27.027
M_8	.699	.739	.706	.684	.632	.606	.575	.550
M_9	.430	.475	.497	.491	.465	.457	.440	.364
$\Delta\beta$	43.445	40.548	40.075	39.805	37.803	36.245	35.768	36.813
$\bar{\omega}$	.202	.103	.066	.056	.040	.058	.071	.206
$\bar{\omega}\cos\beta_9/2\sigma$	.052	.027	.018	.016	.013	.019	.025	.073
D	.543	.507	.453	.453	.444	.427	.429	.542
η_p	.710	.849	.888	.902	.921	.875	.843	.658
i_m	7.931	6.721	8.461	8.537	8.918	9.268	9.691	10.114
i_s	2.191	0.520	1.281	.747	-.432	-1.162	-1.639	-1.286
$\delta°$	16.496	16.393	14.806	13.802	12.795	12.873	13.494	13.261

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 70.0225

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 6211.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 96.200

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 18.3553

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 25.5851

TABLE 2-3 BLADE ELEMENT PERFORMANCE AT 70% DESIGN SPEED, POINT 3, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	50.958	48.048	47.280	46.618	44.068	41.974	42.850	45.428
β_9	6.692	6.928	5.991	5.461	3.603	3.405	3.365	3.089
V_8	761.757	801.803	773.574	752.664	690.288	664.050	632.287	582.223
V_9	468.387	516.396	541.881	534.421	496.827	490.596	465.941	385.705
V_{Z8}	478.852	535.009	524.018	516.347	495.683	493.587	463.545	408.602
V_{Z9}	463.921	511.323	537.818	531.103	495.410	489.567	465.104	385.131
$V_{\theta 8}$	591.647	596.300	568.324	547.032	480.104	444.116	430.007	414.761
$V_{\theta 9}$	54.580	62.284	56.554	50.860	31.217	29.138	27.348	20.782
M_8	.687	.727	.698	.677	.618	.593	.562	.515
M_9	.416	.454	.477	.470	.437	.431	.408	.336
$\Delta\beta$	44.266	41.120	41.289	41.157	40.466	38.569	39.485	42.340
$\bar{\omega}$	.187	.106	.069	.062	.053	.065	.079	.164
$\bar{\omega} \cos\beta_9/2\sigma$	.048	.028	.019	.018	.017	.021	.027	.058
D	.564	.528	.478	.480	.485	.465	.484	.577
η_p	.739	.847	.884	.895	.906	.866	.846	.732
i_m	8.718	7.298	9.670	10.328	10.888	10.724	12.520	14.998
i_s	2.978	1.100	2.490	2.538	1.538	.294	1.190	3.598
$\delta°$	16.462	16.398	14.801	14.241	12.103	12.005	12.605	12.619

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 70.0676

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 6215.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 92.600

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 17.6684

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 24.6277

TABLE 2-4 BLADE ELEMENT PERFORMANCE AT 70% DESIGN SPEED, POINT 4, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	52.103	49.204	48.380	47.501	45.079	44.154	47.314	49.212
β_9	6.844	6.999	6.074	5.669	4.304	3.916	3.920	3.832
V_8	748.982	786.275	761.457	745.421	681.245	646.354	606.922	569.652
V_9	450.877	496.510	523.076	519.135	476.976	458.806	422.759	352.890
V_{Z8}	459.213	512.853	505.082	503.070	480.820	463.667	411.479	372.131
V_{Z9}	446.550	491.681	519.198	515.844	475.281	457.612	421.748	352.092
$V_{\theta 8}$	591.031	595.243	569.239	549.592	482.375	450.247	446.133	431.301
$V_{\theta 9}$	53.729	60.499	55.345	51.278	35.792	31.335	28.899	23.585
M_8	.674	.711	.686	.670	.609	.575	.537	.502
M_9	.394	.436	.460	.456	.418	.402	.368	.306
$\Delta\beta$	45.259	42.205	42.306	41.832	40.775	40.238	43.394	45.380
$\bar{\omega}$	.185	.102	.073	.077	.072	.086	.103	.208
$\bar{\omega} \cos\beta_9/2\sigma$	.048	.027	.020	.022	.023	.028	.036	.074
D	.580	.544	.495	.497	.506	.501	.542	.634
η_p	.748	.855	.881	.873	.878	.838	.818	.687
i_m	9.863	8.454	10.770	11.211	11.899	12.904	16.984	18.782
i_s	4.123	2.254	3.590	3.421	2.549	2.474	5.654	7.382
$\delta°$	16.614	16.469	14.884	14.449	12.804	12.516	13.160	13.362

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 70.0451

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 6213.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 88.700

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 16.9243

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 23.5904

TABLE 2-5 BLADE ELEMENT PERFORMANCE AT 70% DESIGN SPEED, POINT 5, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	53.254	50.323	49.567	48.709	46.704	46.523	51.503	54.127
β_9	2.417	2.582	2.133	1.528	.399	.362	.651	-.118
V_8	744.526	780.307	758.199	745.539	681.187	640.534	596.963	557.624
V_9	435.946	480.502	507.216	505.258	458.047	429.998	389.230	325.623
V_{Z8}	444.643	497.398	491.150	491.522	466.965	440.690	371.593	326.760
V_{Z9}	434.550	479.001	506.041	504.433	457.760	429.901	389.190	325.617
$V_{\theta 8}$	596.582	600.564	577.111	560.178	495.783	464.804	467.208	451.854
$V_{\theta 9}$	18.385	21.646	18.881	13.474	3.192	2.720	4.425	-.671
M_8	.669	.704	.681	.668	.607	.569	.525	.489
M_9	.380	.421	.444	.442	.400	.375	.337	.281
$\Delta\beta$	50.837	47.741	47.433	47.181	46.305	46.161	50.852	54.245
$\bar{\omega}$	.179	.104	.082	.093	.106	.130	.139	.238
$\bar{\omega} \cos\beta_9/2\sigma$	.046	.028	.023	.027	.034	.042	.049	.084
D	.612	.576	.530	.535	.556	.564	.617	.703
η_p	.762	.855	.869	.851	.832	.785	.779	.664
i_m	11.014	9.573	11.957	12.420	13.524	15.273	21.173	23.697
i_s	5.274	3.373	4.777	4.630	4.174	4.843	9.843	12.297
$\delta°$	12.187	12.052	10.943	10.308	8.899	8.962	9.891	9.412

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\text{ DESIGN}} \times 100$ = 70.0564

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 6214.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 85.300

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 16.2755

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 22.6862

TABLE 2-6 BLADE ELEMENT PERFORMANCE AT 70% DESIGN SPEED, POINT 6, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	53.848	50.641	49.930	49.077	47.713	49.586	55.937	60.217
β_9	6.738	6.959	7.033	6.730	5.421	5.876	5.028	1.432
V_8	730.380	765.799	746.849	738.864	674.339	620.317	589.838	544.668
V_9	428.699	474.331	499.885	499.147	442.237	393.328	360.181	298.607
V_{Z8}	430.272	485.045	480.339	483.696	453.633	402.140	330.373	270.547
V_{Z9}	424.940	470.042	495.504	495.238	440.081	391.214	358.787	298.510
$V_{\theta 8}$	589.750	592.110	571.536	558.275	498.868	472.299	488.633	472.723
$V_{\theta 9}$	50.301	57.470	61.206	58.496	41.780	40.264	31.568	7.462
M_8	.655	.689	.670	.661	.600	.549	.517	.475
M_9	.374	.415	.438	.437	.386	.342	.311	.257
$\Delta\beta$	47.110	43.682	42.898	42.347	42.292	43.711	50.909	58.785
$\bar{\omega}$	.188	.110	.093	.113	.148	.174	.201	.295
$\bar{\omega} \cos\beta_9/2\sigma$	.048	.029	.025	.033	.047	.057	.070	.105
D	.600	.561	.515	.520	.558	.593	.659	.754
η_p	.748	.846	.852	.819	.770	.735	.708	.603
i_m	11.608	9.891	12.320	12.787	14.533	18.336	25.607	29.787
i_s	5.868	3.691	5.140	4.997	5.183	7.906	14.277	18.387
$\delta°$	16.508	16.429	15.843	15.510	13.921	14.476	14.268	10.962

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\text{ DESIGN}} \times 100$ = 70.0000

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 6209.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 81.000

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 15.4551

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 21.5426

TABLE 3-1 BLADE ELEMENT PERFORMANCE AT 90% DESIGN SPEED, POINT 1, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	47.779	45.713	44.592	43.445	40.901	39.021	38.648	40.031
β_9	7.231	7.432	7.168	6.268	5.528	6.590	6.175	3.596
V_8	984.247	1032.390	993.395	970.323	922.861	886.824	850.440	805.577
V_9	608.998	686.191	710.049	712.535	707.474	677.220	692.208	586.722
V_{Z8}	659.634	719.251	706.128	703.433	696.979	688.785	664.164	616.818
V_{Z9}	602.261	678.435	702.808	706.859	703.404	672.441	688.115	585.533
$V_{\theta 8}$	728.689	739.042	697.411	667.248	604.248	558.347	531.130	518.149
$V_{\theta 9}$	76.657	88.763	88.595	77.800	68.153	77.720	74.460	36.794
M_8	.899	.950	.908	.884	.835	.799	.761	.716
M_9	.530	.602	.625	.627	.623	.594	.608	.510
$\Delta\beta$	40.547	38.281	37.424	37.176	35.373	32.431	32.473	36.435
$\overline{\omega}$	.300	.167	.150	.110	.072	.142	.089	.188
$\overline{\omega}\ \cos\beta_9/2\sigma$	.077	.044	.041	.032	.023	.046	.031	.066
D	.549	.498	.451	.441	.416	.413	.373	.483
η_p	.608	.773	.764	.816	.864	.724	.784	.660
i_m	5.539	4.963	6.982	7.155	7.721	7.771	8.318	9.601
i_s	-.201	-1.237	-.198	-.635	-1.629	-2.659	-3.012	-1.799
$\delta°$	17.001	16.902	15.978	15.048	14.028	15.190	15.415	13.126

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 89.9887

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 23.6634

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 7982.000

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 32.9840

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 124.020

TABLE 3-2 BLADE ELEMENT PERFORMANCE AT 90% DESIGN SPEED, POINT 2, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	50.310	47.638	45.988	44.713	42.426	40.882	40.330	41.676
β_9	8.019	8.178	7.884	6.235	5.026	5.319	4.822	3.606
V_8	964.749	1018.324	983.658	958.028	901.533	872.506	837.739	789.367
V_9	557.790	627.231	664.410	666.809	650.342	632.489	633.087	529.503
V_{Z8}	614.703	684.675	682.249	679.838	664.959	659.491	638.609	589.589
V_{Z9}	550.646	619.080	656.593	661.580	647.153	629.494	630.779	528.425
$V_{\theta 8}$	742.386	752.446	707.442	674.022	608.212	571.053	542.179	524.859
$V_{\theta 9}$	77.815	89.225	91.132	72.419	56.970	58.631	53.216	33.302
M_8	.875	.932	.896	.869	.812	.782	.746	.699
M_9	.482	.545	.580	.583	.568	.551	.551	.457
$\Delta\beta$	42.291	39.460	38.104	38.478	37.401	35.563	35.508	38.070
$\overline{\omega}$	.263	.157	.126	.089	.058	.109	.081	.186
$\overline{\omega}\ \cos\beta_9/2\sigma$	.068	.041	.034	.026	.018	.035	.028	.066
D	.596	.552	.494	.485	.471	.466	.447	.550
η_p	.679	.806	.822	.867	.904	.811	.845	.710
i_m	8.070	6.888	8.378	8.423	9.246	9.632	10.000	11.246
i_s	2.330	0.700	1.198	.633	-.104	-.798	-1.330	-.154
$\delta°$	17.789	17.648	16.694	15.015	13.526	13.919	14.062	13.136

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 90.0113

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 23.0490

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 7984.000

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 32.1277

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 120.800

TABLE 3-3 BLADE ELEMENT PERFORMANCE AT 90% DESIGN SPEED, POINT 3, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	50.612	47.850	47.066	46.310	43.795	42.704	42.415	43.761
β_9	8.697	8.897	8.713	7.179	5.534	5.510	5.032	4.516
V_8	956.316	1007.905	974.456	952.292	890.520	858.559	822.495	776.573
V_9	545.333	605.300	641.973	642.762	620.370	608.824	596.218	486.198
V_{Z8}	605.517	674.982	662.632	656.902	642.333	630.765	607.213	560.857
V_{Z9}	537.468	596.368	633.134	636.530	616.847	605.761	593.862	484.664
$V_{\theta 8}$	739.100	747.251	713.441	688.587	616.310	582.281	554.768	537.120
$V_{\theta 9}$	82.462	93.609	97.245	80.331	59.831	58.462	52.293	38.279
M_8	.866	.920	.884	.861	.799	.766	.729	.684
M_9	.471	.525	.558	.559	.539	.528	.515	.417
$\Delta\beta$	41.914	38.953	38.354	39.130	38.260	37.193	37.383	39.246
$\bar{\omega}$	.225	.140	.102	.085	.064	.092	.093	.193
$\bar{\omega}\cos\beta_9/2\sigma$	.058	.037	.028	.025	.020	.030	.032	.068
D	.603	.567	.512	.510	.500	.489	.487	.601
η_p	.730	.830	.858	.879	.899	.845	.837	.725
i_m	8.372	7.100	9.456	10.020	10.615	11.454	12.085	13.331
i_s	2.632	0.900	2.276	2.230	1.265	1.024	.755	1.931
$\delta°$	18.467	18.367	17.523	15.959	14.034	14.110	14.272	14.046

PERCENT DESIGN SPEED, $\dfrac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 90.0113

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 7984.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 117.960

CORRECTED FLOW PER UNIT FRONTAL AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_f}$ = 22.5072

CORRECTED FLOW PER UNIT ANNULUS AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_{an}}$ = 31.3723

TABLE 3-4 BLADE ELEMENT PERFORMANCE AT 90% DESIGN SPEED, POINT 4, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	52.162	49.001	48.221	47.359	44.702	43.849	45.352	47.062
β_9	7.070	7.189	7.143	5.388	4.209	3.949	3.859	3.632
V_8	923.506	977.711	947.850	930.097	875.455	824.431	786.640	738.883
V_9	511.328	571.684	614.500	615.885	599.630	572.523	546.183	459.988
V_{Z8}	565.330	640.175	630.541	629.281	621.881	594.431	552.800	503.327
V_{Z9}	506.022	565.719	608.458	612.115	597.472	570.963	544.899	459.044
$V_{\theta 8}$	729.333	737.901	706.827	684.186	615.808	571.136	559.645	540.931
$V_{\theta 9}$	62.934	71.545	76.405	57.833	44.014	39.424	36.757	29.140
M_8	.832	.889	.856	.837	.783	.732	.693	.647
M_9	.440	.494	.533	.534	.520	.495	.469	.393
$\Delta\beta$	45.092	41.812	41.078	41.970	40.492	39.901	41.493	43.430
$\bar{\omega}$	.237	.151	.106	.103	.090	.096	.111	.199
$\bar{\omega}\cos\beta_9/2\sigma$	.061	.040	.029	.030	.028	.031	.038	.071
D	.629	.591	.531	.532	.521	.516	.537	.623
η_p	.718	.818	.855	.854	.863	.838	.818	.713
i_m	9.922	8.251	10.611	11.069	11.522	12.599	15.022	16.632
i_s	4.182	2.051	3.431	3.279	2.172	2.169	3.692	5.232
$\delta°$	16.840	16.659	15.953	14.168	12.709	12.549	13.099	13.162

PERCENT DESIGN SPEED, $\dfrac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 89.9662

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 7980.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 114.740

CORRECTED FLOW PER UNIT FRONTAL AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_f}$ = 21.8928

CORRECTED FLOW PER UNIT ANNULUS AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_{an}}$ = 30.516[illegible]

TABLE 3-5 BLADE ELEMENT PERFORMANCE AT 90% DESIGN SPEED, POINT 5, MCA STATOR A (SLOTTED)

STATOR								
% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	53.183	49.932	49.328	48.637	46.381	46.366	49.863	52.450
β_9	5.703	6.510	6.188	6.037	4.342	4.544	4.806	4.355
V_8	926.854	978.128	950.695	934.171	868.530	822.018	775.398	722.542
V_9	499.618	562.277	600.008	600.815	570.741	542.316	497.094	419.192
V_{Z8}	554.422	628.561	618.788	616.698	598.888	567.153	499.834	440.356
V_{Z9}	495.914	557.377	595.437	596.616	568.687	540.466	495.317	417.969
$V_{\theta 8}$	741.992	748.542	721.057	701.134	628.768	594.950	592.794	572.845
$V_{\theta 9}$	49.644	63.750	64.680	63.188	43.206	42.965	41.644	31.835
M_8	.833	.886	.856	.838	.773	.726	.677	.627
M_9	.429	.485	.518	.518	.492	.465	.423	.355
$\Delta\beta$	47.480	43.422	43.139	42.600	42.040	41.822	45.057	48.094
$\overline{\omega}$	.229	.141	.110	.112	.100	.119	.147	.211
$\overline{\omega} \cos\beta_9/2\sigma$	.059	.037	.030	.033	.032	.039	.051	.075
D	.650	.606	.555	.554	.555	.559	.606	.685
η_p	.735	.833	.853	.847	.856	.815	.784	.717
i_m	10.943	9.182	11.718	12.347	13.201	15.116	19.533	22.020
i_s	5.203	2.982	4.538	4.557	3.851	4.686	8.203	10.620
$\delta°$	15.473	15.980	14.998	14.817	12.842	13.144	14.046	13.885

PERCENT DESIGN SPEED, $\dfrac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100 =$ 90.0113

CORRECTED ROTOR SPEED, $N/\sqrt{\theta} =$ 7984.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta =$ 110.350

CORRECTED FLOW PER UNIT FRONTAL AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_f} =$ 21.0551

CORRECTED FLOW PER UNIT ANNULUS AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_{an}} =$ 29.3484

TABLE 3-6 BLADE ELEMENT PERFORMANCE AT 90% DESIGN SPEED, POINT 6, MCA STATOR A (SLOTTED)

STATOR								
% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	54.160	50.802	49.710	49.943	48.468	49.298	53.665	58.217
β_9	6.787	7.035	6.775	6.162	4.569	5.187	4.254	1.853
V_8	926.920	978.701	965.123	942.463	868.326	813.026	771.682	705.875
V_9	488.561	560.091	605.731	596.013	547.160	505.040	463.977	381.637
V_{Z8}	541.887	617.667	623.441	606.035	575.548	530.150	457.222	371.785
V_{Z9}	484.103	554.793	600.600	591.870	545.115	502.874	462.679	381.429
$V_{\theta 8}$	751.414	758.458	736.178	721.371	650.016	616.366	621.644	600.030
$V_{\theta 9}$	57.740	68.597	71.457	63.972	43.582	45.658	34.420	12.341
M_8	.831	.885	.869	.843	.770	.715	.670	.608
M_9	.418	.482	.522	.512	.469	.431	.392	.321
$\Delta\beta$	47.373	43.767	42.935	43.782	43.899	44.111	49.411	56.364
$\overline{\omega}$	.239	.142	.142	.136	.145	.171	.206	.256
$\overline{\omega} \cos\beta_9/2\sigma$	.062	.037	.039	.040	.046	.056	.071	.091
D	.662	.610	.558	.569	.590	.607	.663	.754
η_p	.726	.832	.814	.819	.801	.758	.719	.674
i_m	11.920	10.052	12.100	13.653	15.288	18.048	23.335	27.787
i_s	6.180	2.852	4.920	5.863	5.938	7.618	12.005	16.387
$\delta°$	16.557	16.505	15.585	14.942	13.069	13.787	13.494	11.383

PERCENT DESIGN SPEED, $\dfrac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100 =$ 89.9662

CORRECTED ROTOR SPEED, $N/\sqrt{\theta} =$ 7980.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta =$ 106.060

CORRECTED FLOW PER UNIT FRONTAL AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_f} =$ 20.2366

CORRECTED FLOW PER UNIT ANNULUS AREA, $\dfrac{W\sqrt{\theta}/\delta}{A_{an}} =$ 28.2074

TABLE 4-1 BLADE ELEMENT PERFORMANCE AT 100% DESIGN SPEED, POINT 1, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	45.932	44.423	44.324	43.892	41.097	39.594	39.481	40.048
β_9	7.123	6.828	4.786	4.778	4.851	5.437	6.091	3.991
V_8	1094.183	1136.508	1091.126	1066.752	1024.162	992.435	966.556	930.257
V_9	640.797	688.298	709.915	709.768	725.806	722.947	722.409	627.696
V_{Z8}	759.286	809.947	779.215	767.633	771.197	764.525	745.985	712.110
V_{Z9}	633.914	681.467	705.774	705.907	722.403	719.358	718.241	626.130
$V_{\theta 8}$	786.182	795.492	762.379	739.581	673.223	632.521	614.564	598.548
$V_{\theta 9}$	79.461	81.833	59.234	59.125	61.379	68.494	76.651	43.692
M_8	1.008	1.055	1.002	.974	.929	.894	.864	.827
M_9	.554	.598	.617	.616	.632	.628	.625	.538
$\Delta\beta$	38.808	37.594	39.537	39.114	36.246	34.157	33.391	36.056
$\bar{\omega}$	.262	.180	.169	.140	.101	.108	.125	.185
$\bar{\omega}\cos\beta_9/2\sigma$	.068	.047	.046	.041	.032	.035	.043	.066
D	.578	.557	.524	.519	.479	.457	.446	.536
η_p	.695	.792	.782	.813	.848	.820	.777	.724
i_m	3.692	3.673	6.714	7.602	7.917	8.344	9.151	9.618
i_s	-2.048	-2.527	-.466	-.188	-1.433	-2.086	-2.179	-1.782
$\delta°$	16.893	16.298	13.596	13.558	13.351	14.037	15.331	13.521

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 99.9098

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 8862.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 134.300

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 25.6249

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 35.7181

TABLE 4-2 BLADE ELEMENT PERFORMANCE AT 100% DESIGN SPEED, POINT 2, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	50.522	48.084	46.518	44.955	42.222	41.476	42.342	42.773
β_9	8.214	9.018	7.377	5.548	3.613	4.495	4.521	4.090
V_8	1076.242	1132.983	1096.303	1075.767	1026.201	991.334	970.612	937.429
V_9	557.181	628.600	678.889	689.376	687.341	681.645	690.765	586.091
V_{Z8}	682.684	755.246	753.065	760.189	759.371	742.528	717.386	688.106
V_{Z9}	549.772	619.050	671.685	684.803	685.230	679.244	688.536	584.562
$V_{\theta 8}$	830.715	843.080	795.468	760.062	689.616	656.571	653.762	636.607
$V_{\theta 9}$	79.601	98.529	87.169	66.648	43.313	53.424	54.452	41.798
M_8	.979	1.042	1.002	.980	.927	.883	.861	.827
M_9	.475	.539	.585	.595	.594	.587	.591	.497
$\Delta\beta$	42.308	39.066	39.141	39.407	38.609	36.961	37.821	38.684
$\bar{\omega}$	.252	.174	.122	.105	.075	.080	.085	.188
$\bar{\omega}\cos\beta_9/2\sigma$	.065	.045	.033	.031	.024	.026	.029	.067
D	.659	.615	.555	.545	.529	.510	.503	.599
η_p	.733	.816	.855	.869	.897	.878	.863	.748
i_m	8.282	7.334	8.908	8.665	9.042	10.226	12.012	12.343
i_s	2.542	1.140	1.728	.875	-.308	-.204	.682	.943
$\delta°$	17.984	18.488	16.187	14.328	12.113	13.095	13.761	13.620

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 100.2661

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 8893.600

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 131.900

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 25.1670

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 36.0788

TABLE 4-3 BLADE ELEMENT PERFORMANCE AT 100% DESIGN SPEED, POINT 3, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	51.978	49.531	48.455	47.246	44.145	43.421	44.762	45.661
β_9	7.606	8.969	6.855	4.742	3.051	3.943	4.532	4.323
V_8	1045.547	1100.524	1068.231	1051.697	1000.778	961.744	948.913	907.992
V_9	511.142	580.003	638.624	660.426	655.839	646.072	652.551	552.488
V_{Z8}	642.478	712.687	707.179	712.898	717.591	698.341	673.744	634.587
V_{Z9}	505.065	571.245	632.552	656.870	654.206	644.268	650.447	550.890
$V_{\theta 8}$	823.659	837.229	799.498	772.237	697.015	661.058	668.184	649.412
$V_{\theta 9}$	67.653	90.426	76.220	54.593	34.911	44.425	51.565	41.647
M_8	.946	1.005	.969	.951	.898	.856	.835	.795
M_9	.434	.495	.547	.567	.563	.553	.554	.465
$\Delta\beta$	44.372	40.561	41.600	42.504	41.093	39.478	40.229	41.338
$\bar{\omega}$	.257	.186	.136	.103	.087	.090	.119	.213
$\bar{\omega} \cos\beta_9/2\sigma$	.066	.049	.037	.030	.028	.029	.041	.075
D	.694	.648	.585	.569	.553	.537	.538	.629
η_p	.733	.806	.841	.872	.883	.866	.818	.718
i_m	9.738	8.781	10.845	10.956	10.965	12.171	14.432	15.231
i_s	3.998	2.581	3.665	3.166	1.615	1.741	3.102	3.831
$\delta°$	17.376	18.439	15.665	13.522	11.551	12.543	13.772	13.853

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 100.1296

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 8881.500

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 128.560

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 24.5297

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 34.1915

TABLE 4-4 BLADE ELEMENT PERFORMANCE AT 100% DESIGN SPEED, POINT 4, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	54.209	51.061	49.721	48.242	44.912	44.816	48.270	49.255
β_9	6.850	8.439	6.607	4.837	2.342	3.594	4.701	3.969
V_8	1037.947	1097.659	1066.313	1050.342	992.802	949.538	926.336	884.513
V_9	500.464	569.236	628.961	645.758	631.983	617.105	605.528	517.104
V_{Z8}	605.695	688.462	688.262	698.612	702.650	673.433	616.578	577.309
V_{Z9}	495.445	561.549	623.419	642.304	630.853	615.662	603.438	515.841
$V_{\theta 8}$	841.937	853.779	813.496	783.517	700.938	669.265	691.311	670.128
$V_{\theta 9}$	59.691	83.541	72.368	54.449	25.829	38.682	49.631	35.788
M_8	.934	.998	.964	.946	.888	.841	.809	.768
M_9	.423	.484	.537	.552	.541	.525	.510	.432
$\Delta\beta$	47.359	42.622	43.114	43.405	42.570	41.222	43.568	45.287
$\bar{\omega}$	.252	.183	.129	.117	.107	.112	.134	.220
$\bar{\omega} \cos\beta_9/2\sigma$	.065	.048	.035	.034	.034	.037	.047	.078
D	.709	.663	.598	.586	.578	.566	.587	.669
η_p	.739	.811	.850	.858	.861	.835	.810	.718
i_m	11.969	10.311	12.111	11.952	11.732	13.566	17.940	18.825
i_s	6.229	4.111	4.931	4.162	2.382	3.136	6.610	7.425
$\delta°$	16.620	17.909	15.417	13.617	10.842	12.194	13.941	13.499

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 100.0631

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 8875.600

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 125.340

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 23.9153

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 33.3351

TABLE 4-5 BLADE ELEMENT PERFORMANCE AT 100% DESIGN SPEED, POINT 5, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22,300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	54.672	51.491	50.810	49.722	46.583	47.223	49.558	51.465
β_9	7.018	8.670	7.545	5.895	2.651	4.502	5.136	3.417
V_8	1019.104	1076.734	1047.364	1034.650	970.984	923.877	911.294	859.792
V_9	501.679	571.147	621.676	634.476	609.510	587.757	575.581	499.006
V_{Z8}	588.092	669.124	660.811	668.082	666.956	627.312	591.127	535.636
V_{Z9}	496.541	563.168	615.015	630.047	608.313	585.744	573.228	498.102
$V_{\theta 8}$	831.436	842.556	811.760	789.351	705.295	678.183	693.549	672.556
$V_{\theta 9}$	61.295	86.097	81.631	65.169	28.187	46.138	51.526	29.746
M_8	.915	.976	.943	.928	.864	.813	.793	.743
M_9	.424	.485	.630	.541	.519	.498	.483	.416
$\Delta\beta$	47.654	42.821	43.264	43.826	43.932	42.721	44.422	48.048
$\bar{\omega}$	.248	.166	.130	.130	.135	.146	.219	.259
$\bar{\omega}\ \mathrm{Cos}\,\beta_9/2\sigma$	.064	.043	.035	.038	.043	.048	.076	.092
D	.699	.651	.595	.589	.592	.587	.613	.684
η_p	.738	.823	.846	.840	.822	.788	.697	.664
i_m	12.432	10.741	13.200	13.432	13.403	15.973	19.228	21.035
i_s	6.692	4.341	6.020	5.642	4.053	5.543	7.898	9.635
$\delta°$	16.788	13.140	16.355	14.675	11.151	13.102	14.376	12.947

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \mathrm{DESIGN}}$ = 100.0417

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 8873.700

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 122.380

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 23.3505

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 32.5479

TABLE 4-6 BLADE ELEMENT PERFORMANCE AT 100% DESIGN SPEED, POINT 6, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	54.048	50.955	50.141	49.339	47.755	48.784	52.291	54.206
β_9	6.732	8.263	7.627	6.622	3.492	4.596	4.037	2.028
V_8	1029.573	1084.627	1058.647	1043.599	970.374	910.776	888.824	840.526
V_9	518.757	591.977	633.636	636.695	590.846	555.302	543.790	460.877
V_{Z8}	603.438	682.157	677.670	679.357	652.105	600.031	543.643	491.595
V_{Z9}	513.963	584.559	626.955	631.575	589.336	553.372	542.410	460.574
$V_{\theta 8}$	833.446	842.383	812.639	791.650	718.360	685.117	703.175	681.775
$V_{\theta 9}$	60.813	85.072	84.093	73.426	35.983	44.497	38.281	16.310
M_8	.926	.984	.954	.936	.861	.799	.769	.723
M_9	.439	.504	.540	.542	.502	.469	.454	.382
$\Delta\beta$	47.315	42.693	42.514	42.717	44.264	44.188	48.254	52.178
$\bar{\omega}$	.236	.146	.131	.139	.150	.157	.188	.260
$\bar{\omega}\ \mathrm{Cos}\,\beta_9/2\sigma$	.061	.038	.036	.040	.048	.051	.065	.092
D	.686	.635	.587	.589	.613	.619	.648	.732
η_p	.749	.843	.843	.830	.810	.788	.749	.679
i_m	11.808	10.205	12.531	13.049	14.575	17.534	21.961	23.776
i_s	6.068	4.005	5.351	5.259	5.225	7.104	10.631	12.376
$\delta°$	16.502	17.733	16.437	15.402	11.992	13.196	13.277	11.558

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \mathrm{DESIGN}}$ = 99.8219

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 8854.200

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 120.500

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 22.9918

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 32.0479

TABLE 5-1 BLADE ELEMENT PERFORMANCE AT 110% DESIGN SPEED, POINT 1, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	49.221	47.188	45.816	44.181	41.478	39.842	41.857	42.457
β_9	11.444	10.465	1.359	1.614	1.955	4.420	4.220	.894
V_8	1183.312	1236.547	1188.479	1164.627	1131.578	1103.895	1069.731	1031.935
V_9	633.031	742.922	747.803	747.100	786.391	768.797	787.125	650.841
V_{Z8}	771.109	838.541	826.850	833.976	847.123	847.337	796.711	761.324
V_{Z9}	618.542	728.464	745.817	745.319	785.049	766.140	784.885	650.712
$V_{\theta 8}$	896.042	907.113	852.264	811.660	749.480	707.232	713.806	696.600
$V_{\theta 9}$	125.598	134.943	17.739	21.043	26.833	59.252	57.919	10.149
M_8	1.084	1.146	1.091	1.065	1.027	.995	.948	.909
M_9	.537	.637	.642	.642	.678	.660	.670	.547
$\Delta\beta$	37.777	36.723	44.457	42.567	39.523	35.421	37.637	41.564
$\bar{\omega}$	.321	.185	.192	.180	.108	.167	.122	.242
$\bar{\omega} \cos\beta_9/2\sigma$	.082	.048	.053	.053	.034	.054	.042	.086
D	.629	.560	.561	.555	.506	.495	.477	.605
η_p	.662	.799	.773	.780	.849	.757	.797	.682
i_m	6.981	6.438	8.206	7.891	8.298	8.592	11.527	12.027
i_s	1.241	0.240	1.026	.101	-1.052	-1.838	.197	.627
$\delta°$	21.214	19.935	10.169	10.394	10.455	13.020	13.460	10.424

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 109.9315

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ =9750.920

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 140.330

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 26.7754

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 37.3218

TABLE 5-2 BLADE ELEMENT PERFORMANCE AT 110% DESIGN SPEED, POINT 2, MCA STATOR A (SLOTTED)

STATOR

SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	54.207	49.789	48.092	46.575	42.697	42.178	44.921	45.722
β_9	5.688	11.037	8.963	6.603	3.678	3.763	3.238	1.927
V_8	1094.824	1166.376	1145.135	1133.244	1096.153	1071.449	1048.448	1005.377
V_9	488.444	570.929	655.555	692.343	711.644	707.283	714.651	601.704
V_{Z8}	638.884	751.430	763.567	777.924	805.054	793.806	742.361	701.888
V_{Z9}	484.550	558.764	646.030	686.407	709.408	705.436	713.421	601.321
$V_{\theta 8}$	688.050	890.735	852.235	823.046	743.317	719.414	740.341	719.806
$V_{\theta 9}$	48.408	109.302	102.128	79.610	45.653	46.414	40.371	20.237
M_8	.987	1.066	1.041	1.027	.988	.957	.920	.876
M_9	.410	.482	.557	.590	.608	.601	.600	.500
$\Delta\beta$	48.519	38.752	39.130	39.972	39.018	38.416	41.683	43.794
$\bar{\omega}$	.243	.239	.159	.116	.085	.106	.099	.190
$\bar{\omega} \cos\beta_9 / 2\sigma$	.063	.062	.043	.034	.027	.034	.035	.067
D	.748	.683	.604	.579	.551	.544	.550	.648
η_p	.764	.766	.829	.867	.893	.856	.857	.764
i_m	11.967	9.039	10.482	10.285	9.517	10.928	14.591	15.292
i_s	6.227	2.839	3.302	2.495	.167	.498	3.261	3.892
$\delta°$	15.458	20.507	17.773	15.383	12.178	12.363	12.478	11.457

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta} \times 100}{N/\sqrt{\theta}\ \text{DESIGN}}$ = 109.9179

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 9749.720

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 137.570

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 26.2488

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 36.5878

TABLE 5-3 BLADE ELEMENT PERFORMANCE AT 110% DESIGN SPEED, POINT 3, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	61.329	51.903	48.665	47.103	43.709	43.655	47.046	47.772
β_9	4.292	10.577	8.827	6.159	2.140	2.926	3.331	1.348
V_8	1064.802	1130.370	1133.442	1123.385	1081.871	1050.236	1025.979	985.101
V_9	470.253	548.944	636.918	678.442	687.912	680.435	671.944	571.761
V_{Z8}	509.920	696.203	747.474	763.733	781.541	759.683	699.088	662.062
V_{Z9}	467.557	538.131	627.946	673.251	686.720	679.264	670.741	571.574
$V_{\theta 8}$	934.248	889.562	851.062	822.967	747.568	724.995	750.920	729.443
$V_{\theta 9}$	35.189	100.766	97.731	72.785	25.683	34.735	39.045	13.455
M_8	.953	1.023	1.026	1.014	.970	.932	.894	.853
M_9	.393	.461	.539	.576	.585	.575	.560	.473
$\Delta\beta$	57.038	41.325	39.839	40.944	41.569	40.729	43.715	46.424
$\bar{\omega}$	.165	.236	.157	.115	.097	.112	.135	.214
$\bar{\omega} \cos\beta_9/2\sigma$	.043	.061	.043	.034	.031	.037	.047	.076
D	.773	.695	.617	.589	.574	.566	.586	.677
η_p	.841	.766	.831	.868	.879	.849	.815	.738
i_m	19.089	11.153	11.055	10.813	10.529	12.405	16.716	17.342
i_s	13.349	4.953	3.875	3.023	1.179	1.975	5.386	5.942
$\delta°$	14.062	20.047	17.637	14.939	10.640	11.526	12.571	10.878

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 109.7565

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 9735.400

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 134.940

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 25.7470

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 35.8883

TABLE 5-4 BLADE ELEMENT PERFORMANCE AT 110% DESIGN SPEED, POINT 4, MCA STATOR (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	56.096	51.955	50.409	48.687	45.366	46.274	49.512	50.187
β_9	4.391	11.895	8.842	6.342	2.238	4.248	2.433	-.089
V_8	1094.415	1162.863	1136.090	1126.184	1077.836	1035.416	1009.366	969.958
V_9	472.015	555.042	636.565	675.779	668.627	644.424	633.010	536.803
V_{Z8}	609.134	715.182	722.851	742.519	756.771	715.533	655.349	621.043
V_{Z9}	469.247	541.639	627.607	670.418	667.460	642.399	632.377	536.773
$V_{\theta 8}$	908.332	915.790	875.489	845.888	767.004	748.247	767.668	745.061
$V_{\theta 9}$	36.136	114.406	97.845	74.649	26.112	47.739	26.874	-.836
M_8	.980	1.055	1.024	1.012	.962	.911	.873	.834
M_9	.393	.465	.537	.571	.565	.540	.524	.441
$\Delta\beta$	51.705	40.060	41.567	42.345	43.128	42.026	47.079	50.276
$\bar{\omega}$	.254	.219	.149	.114	.118	.142	.166	.251
$\bar{\omega} \cos\beta_9/2\sigma$	.066	.057	.040	.033	.037	.046	.058	.089
D	.771	.701	.624	.598	.596	.598	.628	.719
η_p	.756	.788	.841	.870	.857	.812	.782	.701
i_m	13.856	11.205	12.799	12.397	12.186	15.024	19.182	19.757
i_s	6.116	5.005	5.619	4.607	2.836	4.594	7.852	8.357
$\delta°$	14.161	21.365	17.652	15.122	10.738	12.848	11.673	9.44

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 110.0670

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 9762.940

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 132.210

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 25.2261

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 35.1622

TABLE 5-5 BLADE ELEMENT PERFORMANCE AT 110% DESIGN SPEED, POINT 5, MCA STATOR (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	58.911	52.100	49.762	48.296	44.667	46.298	50.588	54.187
β_9	4.428	10.530	9.063	6.839	2.486	4.886	1.963	-.435
V_8	1071.840	1155.705	1151.926	1142.986	1087.442	1037.112	1008.682	931.548
V_9	479.283	561.215	641.928	678.653	660.963	621.019	610.043	517.951
V_{Z8}	552.267	708.517	742.955	759.513	770.311	716.439	640.399	545.091
V_{Z9}	476.503	550.327	632.607	672.701	659.779	618.564	609.637	517.914
$V_{\theta 8}$	917.891	911.954	879.349	853.343	767.157	749.774	779.307	755.418
$V_{\theta 9}$	37.005	102.559	101.115	80.818	28.665	52.892	20.897	-3.931
M_8	.956	1.046	1.040	1.029	.971	.913	.870	.795
M_9	.399	.470	.541	.573	.558	.519	.503	.424
$\Delta\beta$	54.483	41.571	40.700	41.457	42.382	41.412	48.625	54.621
$\bar{\omega}$	.101	.201	.145	.116	.126	.154	.175	.171
$\bar{\omega} \cos\beta_9/2\sigma$	.026	.052	.039	.034	.040	.050	.061	.061
D	.761	.695	.625	.602	.606	.620	.657	.733
η_p	.904	.804	.846	.870	.850	.809	.782	.794
i_m	16.671	11.350	12.152	12.006	11.687	15.048	20.258	23.757
i_s	10.931	5.150	4.972	4.216	2.337	4.618	8.928	12.357
$\delta°$	14.198	20.000	17.873	15.619	10.986	13.486	11.203	9.095

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 109.9654

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 9753.930

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 130.670

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 24.9323

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 34.7527

TABLE 5-6 BLADE ELEMENT PERFORMANCE AT 110% DESIGN SPEED, POINT 6, MCA STATOR A (SLOTTED)

STATOR

% SPAN	95	90	80	70	50	30	10	05
Dia.	22.300	22.680	23.670	24.480	26.350	28.190	30.000	30.540
β_8	56.333	52.929	51.206	49.282	46.777	47.198	52.974	54.759
β_9	5.160	9.973	8.843	6.901	3.305	6.237	.884	-1.264
V_8	1107.021	1170.223	1138.004	1124.541	1067.627	999.516	973.673	924.107
V_9	495.957	576.737	647.090	672.900	642.865	592.948	576.086	482.687
V_{Z8}	612.452	704.093	711.929	732.714	730.736	679.007	586.302	533.215
V_{Z9}	492.619	566.609	638.126	666.943	641.251	589.243	575.975	482.552
$V_{\theta 8}$	921.345	933.705	886.961	852.327	777.978	733.351	777.347	754.749
$V_{\theta 9}$	44.604	99.882	99.473	80.852	37.065	64.422	8.886	-10.648
M_8	.989	1.058	1.023	1.008	.948	.876	.835	.787
M_9	.412	.482	.544	.567	.541	.495	.473	.394
$\Delta\beta$	51.173	42.956	42.363	42.381	43.472	40.961	52.090	56.023
$\bar{\omega}$	.266	.191	.135	.122	.148	.171	.186	.272
$\bar{\omega} \cos\beta_9/2\sigma$	.069	.050	.037	.035	.047	.056	.065	.096
D	.753	.691	.618	.600	.617	.625	.683	.771
η_p	.741	.814	.854	.861	.823	.781	.767	.683
i_m	14.093	12.179	13.596	12.992	13.597	15.948	22.644	24.329
i_s	8.353	5.979	6.416	5.202	4.247	5.518	11.314	12.929
$\delta°$	14.930	19.443	17.653	15.681	11.805	14.837	10.124	8.266

PERCENT DESIGN SPEED, $\frac{N/\sqrt{\theta}}{N/\sqrt{\theta}\ \text{DESIGN}} \times 100$ = 109.9775

CORRECTED ROTOR SPEED, $N/\sqrt{\theta}$ = 9755.000

CORRECTED WEIGHT FLOW, $W\sqrt{\theta}/\delta$ = 128.600

CORRECTED FLOW PER UNIT FRONTAL AREA, $\frac{W\sqrt{\theta}/\delta}{A_f}$ = 24.5373

CORRECTED FLOW PER UNIT ANNULUS AREA, $\frac{W\sqrt{\theta}/\delta}{A_{an}}$ = 34.2021

APPENDIX B

Pressure Coefficient Data Tabulation

TABLE 1-1

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 50 % DESIGN SPEED, POINT 1

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.491	0.196	2.530	0.843	0.361	0.703	33.5	-1.016	2.081	8.5	0.804
40	-1.052	0.263	2.092	0.775	0.299	0.764	35.7	-0.872	1.937	13.5	0.804
45	-0.816	0.331	1.855	0.708	0.423	0.641	38.8	-0.564	1.628	18.8	0.804
50	-0.816	0.398	1.855	0.640	0.361	0.703	40.9	-0.543	1.608	23.7	0.804
60	-0.647	0.398	1.686	0.640	0.464	0.600	51.3	-0.461	1.525	34.1	0.819
70	-0.478	0.364	1.518	0.674	0.402	0.661	56.1	-0.276	1.340	45.8	0.844
							61.0			58.0	0.853
							70.4	-0.091	1.155	71.3	0.859
							79.4	-0.091	1.155		

TABLE 1-2

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 50 % DESIGN SPEED, POINT 2

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.310	0.352	2.349	0.686	0.445	0.617	33.5	-0.920	1.983	8.5	0.816
40	-0.835	0.386	1.874	0.652	0.382	0.680	35.7	-0.731	1.793	13.5	0.822
45	-0.631	0.454	1.670	0.584	0.508	0.554	38.8	-0.437	1.499	18.8	0.822
50	-0.631	0.454	1.670	0.584	0.466	0.596	40.9	-0.395	1.457	23.7	0.825
60	-0.461	0.488	1.500	0.550	0.319	0.743	51.3	-0.374	1.436	34.1	0.841
70	-0.326	0.454	1.365	0.584	0.487	0.575	56.1	-0.184	1.247	45.8	0.892
							61.0			58.0	0.871
							70.4	0.004	1.058	71.3	0.877
							79.4	0.004	1.058		

TABLE 1-3

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 50 % DESIGN SPEED, POINT 3

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.284	0.360	2.320	0.675	0.483	0.578	33.5	-0.808	1.870	8.5	0.824
40	-0.772	0.397	1.808	0.638	0.419	0.641	35.7	-0.639	1.700	13.5	0.833
45	-0.589	0.433	1.625	0.602	0.547	0.514	38.8	-0.321	1.382	18.8	0.833
50	-0.553	0.360	1.589	0.675	0.483	0.578	40.9	-0.321	1.382	23.7	0.839
60	-0.406	0.507	1.442	0.528	0.589	0.472	51.3	-0.257	1.319	34.1	0.854
70	-0.297	0.470	1.333	0.565	0.525	0.535	56.1	-0.088	1.149	45.8	0.872
							61.0			58.0	0.881
							70.4	0.081	0.980	71.3	0.884
							79.4	0.081	0.980		

TABLE 1-4

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 50 % DESIGN SPEED, POINT 4

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.991	0.327	2.023	0.704	0.491	0.569	33.5	-0.754	1.815	8.5	0.831
40	-0.564	0.405	1.596	0.627	0.364	0.696	35.7	-0.522	1.583	13.5	0.837
45	-0.409	0.482	1.441	0.549	0.237	0.822	38.8	-0.290	1.350	18.8	0.843
50	-0.409	0.288	1.441	0.743	0.449	0.611	40.9	-0.268	1.329	23.7	0.846
60	-0.293	0.482	1.325	0.549	0.596	0.464	51.3	-0.184	1.245	34.1	0.863
70	-0.215	0.482	1.247	0.549	0.533	0.527	56.1	-0.036	1.097	45.8	0.875
							61.0			58.0	0.884
							70.4	0.132	0.928	71.3	0.890
							79.4	0.132	0.928		

TABLE 1-5

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 50% DESIGN SPEED, POINT 5

% Chord	C_p 10% Span		S Factor 10% Span		C_p 90% Span	S Factor 90% Span	% Chord	C_p 90% Span	S Factor 90% Span	% Chord	Hub/Mid Channel Ratio
	Suction Surface	Pressure Surface	Suction Surface	Pressure Surface	Pressure Surface	Pressure Surface		Suction Surface	Suction Surface		p/p_8
15											
20											
25											
30											
35	-0.693	0.347	1.723	0.683	0.526	0.527	33.5	-0.783	1.837	8.5	0.837
40	-0.372	0.387	1.403	0.643	0.411	0.642	35.7	-0.553	1.608	13.5	0.849
45	-0.252	0.467	1.283	0.563	0.044	1.010	38.8	-0.300	1.355	18.8	0.855
50	0.067	0.187	0.963	0.843	0.503	0.550	40.9	-0.277	1.332	23.7	0.861
60	-0.092	0.467	1.123	0.563	0.618	0.436	51.3	-0.185	1.240	34.1	0.876
70	-0.092	0.467	1.123	0.563	0.549	0.504	56.1	-0.047	1.102	45.8	0.887
							61.0			58.0	0.896
							70.4	0.112	0.941	71.3	0.902
							79.4	0.112	0.941		

TABLE 1-6

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 50% DESIGN SPEED, POINT 6

% Chord	C_p 10% Span		S Factor 10% Span		C_p 90% Span	S Factor 90% Span	% Chord	C_p 90% Span	S Factor 90% Span	% Chord	Hub/Mid Channel Ratio
	Suction Surface	Pressure Surface	Suction Surface	Pressure Surface	Pressure Surface	Pressure Surface		Suction Surface	Suction Surface		p/p_8
15											
20											
25											
30											
35	-0.625	0.363	1.658	0.669	0.537	0.521	33.5	-0.689	1.748	8.5	0.838
40	-0.295	0.404	1.328	0.627	0.472	0.586	35.7	-0.452	1.511	13.5	0.835
45	-0.130	0.487	1.163	0.545	0.580	0.478	38.8	-0.172	1.231	18.8	0.841
50	-0.089	0.240	1.122	0.792	0.558	0.500	40.9	-0.194	1.253	23.7	0.861
60	-0.048	0.528	1.081	0.504	0.623	0.435	51.3	-0.129	1.188	34.1	0.876
70	-0.048	0.446	1.081	0.586	0.580	0.478	56.1	0.042	1.016	45.8	0.887
							61.0			58.0	0.896
							70.4	0.171	0.887	71.3	0.899
							79.4	0.171	0.887		

TABLE 2-1

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 70% DESIGN SPEED, POINT 1

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio p/p_8
15											
20											
25											
30											
35	-1.505	0.273	2.588	0.809	0.413	0.719	33.5	-0.976	2.109	8.5	0.658
40	-0.951	0.357	2.034	0.725	0.930	0.203	35.7	-1.114	2.247	13.5	0.658
45	-0.716	0.391	1.799	0.691	0.470	0.662	38.8	-0.436	1.570	18.8	0.649
50	-0.716	0.458	1.799	0.624	0.436	0.696	40.9	-0.517	1.650	23.7	0.649
60	-0.515	0.441	1.598	0.641	0.528	0.605	51.3	-0.344	1.478	34.1	0.684
70	-0.330	0.458	1.413	0.624	0.482	0.651	56.1	-0.183	1.317	45.8	0.724
							61.0			58.0	0.745
							70.4	0.034	1.099	71.3	0.759
							79.4	0.022	1.110		

TABLE 2-2

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 70% DESIGN SPEED, POINT 2

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio p/p_8
15											
20											
25											
30											
35	-1.337	0.372	2.416	0.706	0.495	0.633	33.5	-0.965	2.093	8.5	0.673
40	-0.727	0.423	1.806	0.655	0.552	0.575	35.7	-0.861	1.990	13.5	0.679
45	-0.558	0.474	1.637	0.604	0.564	0.564	38.8	-0.321	1.449	18.8	0.679
50	-0.524	0.457	1.603	0.621	0.541	0.587	40.9	-0.367	1.495	23.7	0.690
60	-0.355	0.525	1.434	0.553	0.598	0.529	51.3	-0.298	1.426	34.1	0.721
70	-0.219	0.508	1.298	0.570	0.552	0.575	56.1	-0.091	1.219	45.8	0.755
							61.0			58.0	0.772
							70.4	0.115	1.012	71.3	0.784
							79.4	0.104	1.024		

TABLE 2-3

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 70 % DESIGN SPEED, POINT 3

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.291	0.438	2.361	0.632	0.539	0.584	33.5	-0.834	1.958	8.5	0.691
40	-0.689	0.475	1.759	0.594	0.504	0.619	35.7	-0.671	1.795	13.5	0.702
45	-0.482	0.532	1.553	0.538	0.597	0.526	38.8	-0.252	1.376	18.8	0.710
50	-0.464	0.457	1.534	0.613	0.562	0.561	40.9	-0.275	1.399	23.7	0.738
60	-0.294	0.569	1.365	0.500	0.644	0.479	51.3	-0.194	1.317	34.1	0.752
70	-0.182	0.569	1.252	0.500	0.586	0.537	56.1	-0.019	1.143	45.8	0.780
							61.0			58.0	0.794
							70.4	0.166	0.956	71.3	0.803
							79.4	0.178	0.945		

TABLE 2-4

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 70 % DESIGN SPEED, POINT 4

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.046	0.456	2.112	0.609	0.548	0.570	33.5	-0.807	1.926	8.5	0.700
40	-0.526	0.475	1.592	0.590	0.501	0.617	35.7	-0.583	1.702	13.5	0.719
45	-0.371	0.533	1.437	0.532	0.607	0.511	38.8	-0.229	1.348	18.8	0.728
50	-0.526	0.418	1.592	0.647	0.571	0.547	40.9	-0.206	1.325	23.7	0.739
60	-0.198	0.553	1.264	0.512	0.654	0.464	51.3	-0.159	1.278	34.1	0.766
70	-0.102	0.360	1.168	0.705	0.595	0.523	56.1	0.017	1.101	45.8	0.794
							61.0			58.0	0.805
							70.4	0.194	0.924	71.3	0.816
							79.4	0.194	0.924		

TABLE 2-5

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 70 % DESIGN SPEED, POINT 5

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio p/p_8
15											
20											
25											
30											
35	-0.722	0.469	1.784	0.592	0.524	0.592	33.5	-0.726	1.843	8.5	0.709
40	-0.325	0.509	1.387	0.552	0.500	0.616	35.7	-0.490	1.607	13.5	0.731
45	-0.166	0.450	1.228	0.612	0.512	0.604	38.8	-0.171	1.288	18.8	0.739
50	-0.166	0.569	1.228	0.492	0.571	0.545	40.9	-0.171	1.288	23.7	0.753
60	-0.066	0.529	1.129	0.532	0.547	0.569	51.3	-0.100	1.218	34.1	0.777
70	0.012	0.529	1.049	0.532	0.618	0.498	56.1	0.075	1.041	45.8	0.802
							61.0			58.0	0.813
							70.4	0.229	0.887	71.3	0.821
							79.4	0.217	0.899		

TABLE 2-6

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 70 % DESIGN SPEED, POINT 6

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio p/p_8
15											
20											
25											
30											
35	-0.653	0.368	1.711	0.690	0.564	0.547	33.5	-0.777	1.889	8.5	0.715
40	-0.408	0.408	1.466	0.649	0.492	0.619	35.7	-0.501	1.613	13.5	0.734
45	-0.061	0.429	1.119	0.629	0.600	0.512	38.8	-0.202	1.314	18.8	0.744
50	-0.122	0.265	1.180	0.792	0.564	0.547	40.9	-0.166	1.278	23.7	0.755
60	-0.101	0.470	1.160	0.588	0.648	0.464	51.3	-0.130	1.242	34.1	0.782
70	-0.061	0.429	1.119	0.629	0.588	0.523	56.1	0.049	1.062	45.8	0.801
							61.0			58.0	0.814
							70.4	0.193	0.919	71.3	0.812
							79.4	0.169	0.943		

TABLE 3-1

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 90% DESIGN SPEED, POINT 1

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.351	0.179	2.488	0.957	0.378	0.840	33.5	-0.178	1.397	8.5	0.510
40	-1.568	0.233	2.705	0.903	0.362	0.856	35.7	-0.727	1.945	13.5	0.521
45	-1.177	0.353	2.314	0.783	0.450	0.767	38.8	-0.702	1.921	18.8	0.516
50	-0.928	0.407	2.064	0.729	0.442	0.775	40.9	-0.815	2.034	23.7	0.497
60	-0.504	0.429	1.641	0.707	0.523	0.695	51.3	-0.291	1.510	34.1	0.527
70	-0.385	0.418	1.521	0.718	0.483	0.735	56.1	-0.065	1.284	45.8	0.602
							61.0			58.0	0.624
							70.4	-0.033	1.251	71.3	0.629
							79.4	-0.097	1.316		

TABLE 3-2

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 90 % DESIGN SPEED, POINT 2

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.574	0.305	2.704	0.824	0.468	0.737	33.5	-0.535	1.741	8.5	0.519
40	-1.279	0.305	2.409	0.824	0.476	0.729	35.7	-0.907	2.114	13.5	0.543
45	-0.645	0.272	1.775	0.857	0.541	0.665	38.8	-0.154	1.361	18.8	0.556
50	-0.568	0.305	1.698	0.824	0.306	0.899	40.9	-0.624	1.831	23.7	0.556
60	-0.350	0.174	1.480	0.955	0.533	0.673	51.3	-0.049	1.256	34.1	0.604
70	-0.219	0.218	1.349	0.911	0.533	0.673	56.1	0.015	1.191	45.8	0.654
							61.0			58.0	0.670
							70.4	0.193	1.013	71.3	0.680
							79.4	0.163	1.037		

TABLE 3-3

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED)
90 % DESIGN SPEED, POINT 3

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.333	0.125	2.458	0.999	0.504	0.697	33.5	-0.583	1.785	8.5	0.536
40	-0.703	0.445	1.828	0.678	0.480	0.721	35.7	-0.817	2.019	13.5	0.578
45	-0.438	0.511	1.562	0.612	0.440	0.761	38.8	-0.067	1.269	18.8	0.599
50	-0.438	0.434	1.562	0.689	0.617	0.584	40.9	-0.301	1.503	23.7	0.606
60	-0.206	0.556	1.330	0.568	0.665	0.536	51.3	0.021	1.180	34.1	0.635
70	-0.129	0.545	1.253	0.579	0.633	0.568	56.1	0.053	1.148	45.8	0.695
							61.0			58.0	0.695
							70.4	0.230	0.971	71.3	0.705
							79.4	0.206	0.995		

TABLE 3-4

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED)
90 % DESIGN SPEED, POINT 4

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-1.279	0.408	2.390	0.702	0.544	0.640	33.5	-0.663	1.848	8.5	0.568
40	-0.547	0.455	1.658	0.655	0.528	0.657	35.7	-0.638	1.823	13.5	0.606
45	-0.429	0.503	1.540	0.607	0.594	0.590	38.8	-0.067	1.252	18.8	0.627
50	-0.382	0.385	1.493	0.725	0.594	0.590	40.9	-0.166	1.352	23.7	0.639
60	-0.264	0.550	1.375	0.560	0.652	0.533	51.3	0.007	1.178	34.1	0.670
70	-0.110	0.550	1.221	0.560	0.619	0.566	56.1	0.081	1.104	45.8	0.700
							61.0			58.0	0.711
							70.4	0.238	0.946	71.3	0.721
							79.4	0.197	0.988		

TABLE 3-5

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 90 % DESIGN SPEED, POINT 5

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.916	0.431	2.020	0.672	0.572	0.613	33.5	-0.561	1.747	8.5	0.592
40	-0.358	0.491	1.461	0.611	0.589	0.597	35.7	-0.521	1.707	13.5	0.627
45	-0.260	0.528	1.364	0.575	0.621	0.564	38.8	-0.038	1.224	18.8	0.647
50	-0.200	0.394	1.303	0.708	0.621	0.564	40.9	-0.086	1.272	23.7	0.659
60	-0.115	0.552	1.218	0.551	0.677	0.508	51.3	0.057	1.128	34.1	0.686
70	-0.005	0.564	1.109	0.538	0.629	0.556	56.1	0.130	1.055	45.8	0.709
							61.0			58.0	0.721
							70.4	0.267	0.918	71.3	0.734
							79.4	0.234	0.951		

TABLE 3-6

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 90 % DESIGN SPEED, POINT 6

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.729	0.394	1.826	0.702	0.580	0.605	33.5	-0.671	1.857	8.5	0.591
40	-0.305	0.431	1.402	0.665	0.540	0.644	35.7	-0.513	1.698	13.5	0.628
45	-0.205	0.469	1.302	0.627	0.619	0.565	38.8	-0.085	1.270	18.8	0.648
50	-0.142	0.319	1.239	0.777	0.603	0.581	40.9	-0.085	1.270	23.7	0.660
60	-0.205	0.494	1.302	0.602	0.675	0.510	51.3	-0.022	1.207	34.1	0.689
70	-0.167	0.469	1.264	0.627	0.635	0.549	56.1	0.128	1.056	45.8	0.711
							61.0			58.0	0.723
							70.4	0.263	0.922	71.3	0.733
							79.4	0.239	0.946		

TABLE 4-1

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 100 % DESIGN SPEED, POINT 1

% Chord	C_p 10% Span		S Factor 10% Span		C_p 90% Span	S Factor 90% Span	% Chord	C_p 90% Span	S Factor 90% Span	% Chord	Hub/Mid Channel Ratio
	Suction Surface	Pressure Surface	Suction Surface	Pressure Surface	Pressure Surface	Pressure Surface		Suction Surface	Suction Surface		P/P_8
15											
20											
25											
30											
35	-0.931	0.175	2.115	1.008	0.357	0.922	33.5	-0.037	1.317	8.5	0.449
40	-1.111	0.252	2.295	0.931	0.350	0.929	35.7	-0.502	1.782	13.5	0.462
45	-1.137	0.398	2.321	0.785	0.477	0.802	38.8	-0.608	1.888	18.8	0.470
50	-1.017	0.433	2.201	0.750	0.492	0.788	40.9	-0.594	1.874	23.7	0.449
60	-0.467	0.433	1.651	0.750	0.562	0.717	51.3	-0.685	1.966	34.1	0.370
70	-0.407	0.433	1.591	0.750	0.569	0.710	56.1	-0.128	1.409	45.8	0.512
							61.0			58.0	0.549
							70.4	-0.051	1.331	71.3	0.559
							79.4	-0.121	1.402		

TABLE 4-2

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 100 % DESIGN SPEED, POINT 2

% Chord	C_p 10% Span		S Factor 10% Span		C_p 90% Span	S Factor 90% Span	% Chord	C_p 90% Span	S Factor 90% Span	% Chord	Hub/Mid Channel Ratio
	Suction Surface	Pressure Surface	Suction Surface	Pressure Surface	Pressure Surface	Pressure Surface		Suction Surface	Suction Surface		P/P_8
15											
20											
25											
30											
35	-1.109	0.465	2.293	0.718	0.594	0.669	33.5	-0.204	1.468	8.5	0.474
40	-0.912	0.506	2.096	0.677	0.580	0.683	35.7	-0.607	1.871	13.5	0.507
45	-0.453	0.571	1.637	0.612	0.580	0.683	38.8	-0.042	1.305	18.8	0.541
50	-0.305	0.506	1.489	0.677	0.594	0.669	40.9	-0.247	1.510	23.7	0.559
60	-0.273	0.629	1.457	0.554	0.707	0.556	51.3	0.063	1.199	34.1	0.600
70	0.005	0.612	1.178	0.571	0.693	0.570	56.1	0.162	1.100	45.8	0.641
							61.0			58.0	0.646
							70.4	0.275	0.987	71.3	0.654
							79.4	0.240	1.022		

TABLE 4-3

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 100 % DESIGN SPEED, POINT 3

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio p/P_8
15											
20											
25											
30											
35	-1.264	0.041	2.434	1.127	0.285	0.958	33.5	-0.360	1.604	8.5	0.450
40	-0.636	0.083	1.805	1.085	0.291	0.952	35.7	-0.668	1.912	13.5	0.473
45	-0.601	0.119	1.770	1.050	0.291	0.952	38.8	-0.167	1.411	18.8	0.494
50	-0.530	0.048	1.699	1.120	0.334	0.909	40.9	-0.281	1.526	23.7	0.509
60	-0.438	0.161	1.608	1.007	0.358	0.885	51.3	-0.227	1.471	34.1	0.537
70	-0.318	0.161	1.488	1.007	0.340	0.903	56.1	-0.070	1.314	45.8	0.562
							61.0			58.0	0.567
							70.4	0.014	1.230	71.3	0.573
							79.4	-0.004	1.248		

TABLE 4-4

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 100 % DESIGN SPEED, POINT 4

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio p/P_8
15											
20											
25											
30											
35	-0.848	0.475	2.006	0.682	0.639	0.597	33.5	-0.218	1.456	8.5	0.581
40	-0.212	0.535	1.369	0.621	0.632	0.604	35.7	-0.373	1.611	13.5	0.603
45	-0.178	0.561	1.335	0.596	0.667	0.569	38.8	0.126	1.111	18.8	0.603
50	-0.092	0.449	1.249	0.707	0.674	0.562	40.9	0.041	1.196	23.7	0.596
60	-0.040	0.604	1.197	0.553	0.717	0.520	51.3	0.196	1.041	34.1	0.650
70	0.088	0.612	1.069	0.544	0.681	0.555	56.1	0.238		45.8	0.674
							61.0			58.0	0.684
							70.4	0.330		71.3	0.691
							79.4	0.294	0.942		

TABLE 4-5

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 100 % DESIGN SPEED, POINT 5

% Chord	C_p 10% Span		S Factor 10% Span		C_p 90% Span	S Factor 90% Span	% Chord	C_p 90% Span	S Factor 90% Span	% Chord	Hub/Mid Channel Ratio
	Suction Surface	Pressure Surface	Suction Surface	Pressure Surface	Pressure Surface	Pressure Surface		Suction Surface	Suction Surface		p/P_8
15											
20											
25											
30											
35	-0.784	0.416	1.931	0.731	0.617	0.610	33.5	-0.252	1.479	8.5	0.572
40	-0.232	0.451	1.379	0.695	0.588	0.638	35.7	-0.259	1.486	13.5	0.596
45	-0.179	0.495	1.326	0.652	0.659	0.568	38.8	0.091	1.135	18.8	0.612
50	-0.118	0.346	1.265	0.801	0.638	0.589	40.9	0.035	1.192	23.7	0.627
60	-0.056	0.530	1.204	0.617	0.701	0.525	51.3	0.161	1.065	34.1	0.658
70	0.013	0.512	1.134	0.634	0.602	0.624	56.1	0.224	1.002	45.8	0.679
							61.0			58.0	0.691
							70.4	0.315	0.911	71.3	0.703
							79.4	0.252	0.974		

TABLE 4-6

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 100 % DESIGN SPEED, POINT 6

% Chord	C_p 10% Span		S Factor 10% Span		C_p 90% Span	S Factor 90% Span	% Chord	C_p 90% Span	S Factor 90% Span	% Chord	Hub/Mid Channel Ratio
	Suction Surface	Pressure Surface	Suction Surface	Pressure Surface	Pressure Surface	Pressure Surface		Suction Surface	Suction Surface		p/P_8
15											
20											
25											
30											
35	-0.686	0.469	1.825	0.669	0.632	0.600	33.5	-0.286	1.519	8.5	0.575
40	-0.218	0.487	1.357	0.650	0.632	0.600	35.7	-0.320	1.553	13.5	0.601
45	-0.127	0.542	1.265	0.595	0.680	0.552	38.8	0.097	1.135	18.8	0.620
50	-0.090	0.359	1.228	0.779	0.680	0.552	40.9	0.090	1.142	23.7	0.634
60	0.001	0.579	1.137	0.559	0.721	0.511	51.3	0.159	1.073	34.1	0.662
70	0.038	0.552	1.100	0.586	0.680	0.552	56.1	0.371	0.861	45.8	0.686
							61.0			58.0	0.695
							70.4	0.344	0.888	71.3	0.705
							79.4	0.268	0.964		

TABLE 5-1

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 110 % DESIGN SPEED, POINT 1

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.749	-0.091	1.974	1.316	0.109	1.220	33.5	-0.226	1.555	8.5	0.398
40	-0.763	0.194	1.988	1.030	-0.114	1.443	35.7	-0.567	1.897	13.5	0.395
45	-0.871	0.351	2.095	0.873	0.488	0.841	38.8	-0.642	1.971	18.8	0.408
50	-0.921	0.423	2.145	0.801	0.475	0.853	40.9	-0.611	1.940	23.7	0.417
60	-0.685	0.459	1.909	0.765	0.556	0.773	51.3	-0.611	1.940	34.1	0.330
70	-0.477	0.466	1.702	0.758	0.556	0.773	56.1	-0.145	1.474	45.8	0.430
							61.0			58.0	0.469
							70.4	-0.089	1.418	71.3	0.476
							79.4	-0.182	1.512		

TABLE 5-2

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 110 % DESIGN SPEED, POINT 2

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.993	0.484	2.201	0.723	0.680	0.608	33.5	-0.350	1.639	8.5	0.521
40	-0.595	0.534	1.803	0.673	0.680	0.608	35.7	-0.576	1.865	13.5	0.547
45	-0.325	0.591	1.533	0.617	0.701	0.587	38.8	0.051	1.237	18.8	0.557
50	-0.197	0.498	1.405	0.709	0.729	0.559	40.9	-0.181	1.470	23.7	0.582
60	-0.055	0.647	1.263	0.560	0.722	0.566	51.3	0.136	1.152	34.1	0.605
70	0.058	0.640	1.150	0.567	0.758	0.530	56.1	0.200	1.088	45.8	0.631
							61.0			58.0	0.641
							70.4	0.277	1.011	71.3	0.641
							79.4	0.369	0.919		

TABLE 5-3

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 110 % DESIGN SPEED, POINT 3

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.779	0.520	1.975	0.676	0.748	0.518	33.5	-0.394	1.661	8.5	0.564
40	-0.197	0.555	1.394	0.640	0.777	0.489	35.7	-0.512	1.779	13.5	0.584
45	-0.118	0.606	1.315	0.590	0.777	0.489	38.8	0.180	1.086	18.8	0.595
50	-0.039	0.484	1.236	0.712	0.821	0.445	40.9	0.040	1.226	23.7	0.610
60	0.032	0.649	1.164	0.547	0.807	0.459	51.3	0.239	1.027	34.1	0.646
70	0.103	0.634	1.092	0.561	0.844	0.423	56.1	0.269	0.998	45.8	0.672
							61.0			58.0	0.682
							70.4	0.364	0.902	71.3	0.685
							79.4	0.394	0.872		

TABLE 5-4

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 110 % DESIGN SPEED, POINT 4

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.567	0.491	1.755	0.695	0.649	0.625	33.5	-0.400	1.675	8.5	0.538
40	-0.181	0.506	1.368	0.681	0.662	0.612	35.7	-0.459	1.734	13.5	0.554
45	-0.073	0.577	1.261	0.609	0.669	0.605	38.8	0.124	1.150	18.8	0.566
50	-0.030	0.420	1.218	0.767	0.708	0.566	40.9	0.039	1.235	23.7	0.582
60	0.040	0.613	1.146	0.573	0.701	0.573	51.3	0.190	1.084	34.1	0.618
70	0.076	0.584	1.110	0.602	0.721	0.553	56.1	0.222	1.052	45.8	0.644
							61.0			58.0	0.649
							70.4	0.308	0.966	71.3	0.653
							79.4	0.301	0.973		

TABLE 5-5

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 110 % DESIGN SPEED, POINT 5

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.445	0.543	1.616	0.628	0.800	0.484	33.5	-0.354	1.639	8.5	0.573
40	-0.178	0.566	1.350	0.604	0.815	0.469	35.7	-0.441	1.727	13.5	0.593
45	-0.061	0.629	1.232	0.541	0.830	0.455	38.8	0.205	1.080	18.8	0.606
50	-0.013	0.456	1.185	0.714	0.866	0.419	40.9	0.117	1.167	23.7	0.624
60	0.064	0.660	1.106	0.510	0.866	0.419	51.3	0.284	1.000	34.1	0.664
70	0.088	0.637	1.083	0.534	0.888	0.397	56.1	0.321	0.964	45.8	0.689
							61.0			58.0	0.696
							70.4	0.415	0.869	71.3	0.704
							79.4	0.415	0.869		

TABLE 5-6

PRESSURE COEFFICIENT DATA, MCA STATOR A (SLOTTED) 110 % DESIGN SPEED, POINT 6

% Chord	C_p 10% Span Suction Surface	C_p 10% Span Pressure Surface	S Factor 10% Span Suction Surface	S Factor 10% Span Pressure Surface	C_p 90% Span Pressure Surface	S Factor 90% Span Pressure Surface	% Chord	C_p 90% Span Suction Surface	S Factor 90% Span Suction Surface	% Chord	Hub/Mid Channel Ratio P/P_8
15											
20											
25											
30											
35	-0.464	0.493	1.629	0.672	0.626	0.642	33.5	-0.301	1.571	8.5	0.510
40	-0.199	0.532	1.364	0.633	0.638	0.630	35.7	-0.444	1.713	13.5	0.512
45	-0.090	0.570	1.255	0.594	0.669	0.599	38.8	0.100	1.168	18.8	0.553
50	-0.051	0.399	1.217	0.765	0.676	0.593	40.9	0.013	1.255	23.7	0.548
60	0.010	0.602	1.154	0.563	0.706	0.562	51.3	0.162	1.107	34.1	0.607
70	0.041	0.602	1.123	0.563	0.694	0.574	56.1	0.218	1.051	45.8	0.617
							61.0			58.0	0.644
							70.4	0.298	0.970	71.3	0.651
							79.4	0.261	1.008		

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